A venous ulcer This photograph demonstrates ulceration, eczema, pigmentation and oedema Below the internal malleolus an "ankle flare" is present This condition is all too common owing to the lack of early treatment

VARICOSE VEINS

A Practical Manual

BY

R ROWDEN FOOTE

LONDON

THIRD EDITION

With the assistance of

A GORDON DINGLEY

M.A., M Chir (Cantab) F R.C.S

Consultant Surgeon to the Southend-on-Sea Group of Hospitals
Late Surgical Chief Assistant St Bartholomew's Hospital London



BRISTOL JOHN WRIGHT & SONS LTD

1960

First published	July, 1949
Revised and reprinted	March, 1952
Second edition	May, 1954
Third edition	October, 1960

PRINTED IN GREAT BRITAIN
BY JOHN WRIGHT AND SONS LTD
AT THE STONEBRIDGE PRESS,
BRISTOL

To The Pioneers of Varicose Vein Surgery in all Countries

and especially to

ARTHUR DICKSON WRIGHT

of Great Britain

"This is a case in which there is no question about the patient's life or death, and I think it very probable that many among you may pass by the bed-side of such a patient without thinking it worthy of attention But I am not disposed to regard it in this manner Although the patient will not probably die of this disease, yet, without great care, it may render her miserable The disease may be very much relieved by art, and it is one of very common occurrence such a case as may meet you at every turn of your practice, and your reputation in early life will depend more upon your understanding a case of this kind, than upon your knowledge of one of more rare occurrence" *Sir Benjamin Brodie* (1846) *lecturing at the bed-side of a patient suffering from varicose ulceration*

PREFACE TO THIRD EDITION

DURING THE past eleven years some 12,000 copies of this manual have been bought by the profession I find that there is still a demand It is most gratifying to feel that the interest in varicose vein problems has grown With the valuable help of Mr A Gordon Dingley I have rewritten the main portion of this manual since great changes have taken place since the last edition Both sides of the controversy of anti-coagulant treatment are discussed as is the difference of opinion over the surgical treatment of the venous ulcer Physiotherapy and exercises are described in more detail, since they are now so important in the therapy of the indurated limb Stripping operations on the varix are discussed more fully and I hope the reader will find the book to be *practical* since this has been our main ambition

R ROWDEN FOOTE

171 Harley Street W 1
September 1960

PREFACE TO FIRST EDITION

A BOOK written solely on the subject of varicose veins does not yet appear to have been published in Great Britain There are probably five million sufferers from varicose veins in this country alone and it seems to me that the various aspects of this prevalent disease might well be collected and presented in one manual

Varicose veins are important to the individual They are also a national problem. The total number of man hours lost in industry alone from phlebitis and ulceration is extensive The cost to the nation in dressings drugs and in loss of labour though difficult to estimate, must be considerable

A chapter on the historical aspect of the treatment of varices has been introduced into what I hope is otherwise a practical book I suggest that it is only from a study of the work of the pioneers in this branch of medicine that we can learn to appreciate the recent advances in therapy

We cannot yet offer the patient with varicose veins completely satisfactory treatment but we can say that *all sufferers can be benefited* that the majority of complications can be prevented and that a high percentage of those who consult us can be cured. Facilities for specialized varicose vein clinics are still lacking in many of our hospitals Until varices reach the same importance as for a matter of comparison, do fractures, very little progress will be made

Critics may complain that some portions of this manual are written in a dogmatic manner I shall accept this criticism, as I feel that this is the only method open to me in order to impress the busy reader with salient facts in treatment There are also purposeful omissions—such as full discussion of lumbar sympathectomy and femoral embolectomy which receive but scant consideration Only those matters which strike me as being of general practical use have been discussed

PREFACE TO FIRST EDITION

The production of this book has been greatly facilitated by the careful help of many friends I would especially like to thank the following T Proudfoot, M B E , of Messrs Bell & Croyden, who has spent much time in helping to evolve the two-way-stretch bandage, the nutmeg-grater needle head and several other instruments Arnold Lucas, of Messrs Smith & Nephew, who has been of considerable help in the supplying of specialized bandages and in the production of many photographs W J Bishop, of the Wellcome Historical Museum, who has checked much of the historical data and dealt with the index To my secretary, Mrs Ida Sidebotham, who has helped in the preparation of this book, I am especially grateful Finally, I wish to thank the publishers who have never failed to give help when required throughout all the difficulties of publication

I am also grateful to the nurses, surgical instrument makers and chemists who have always assisted me in my varicose vein clinic and have shown how necessary it is to have a co-operative team in the attack against the varix

If this book serves only to stimulate interest in what is thought by some to be a dull subject, I shall be more than content

137 Harley Street, W 1
June, 1949

R ROWDEN FOOTE

ACKNOWLEDGMENTS

I wish to express my thanks to the following for permission to use illustrations which have appeared elsewhere

The Editors of the *Lancet* the *Practitioner* the *British Medical Journal* *Surgery Gynecology and Obstetrics* *Journal of the American Medical Association* *Canadian Medical Association Journal* *Postgraduate Medical Journal* the *Medical Press* *Proceedings of the Royal Society of Medicine* the *Journal of Anatomy* W B Saunders Company of Philadelphia the Central Council for Health Education, London and to Messrs. H K. Lewis (for permission to use the photographs and diagrams which appeared in my book *Varicose Veins Haemorrhoids and Other Conditions* (1944)) to Messrs Duckworth (for permission to use photographs and diagrams which appeared in my book *Varicose Veins* (1954)) and to Messrs. E. & S Livingstone (for permission to use photographs and diagrams which appeared in my book *The Physical Treatment of Varicose Ulcers* (1958))

I am very much indebted to the following for certain photographs and diagrams Dr Robert Linton of Boston Sir James Paterson Ross for permission to use photographs from St. Bartholomew's Hospital Photographic Department Mr P Paton Philip Professor F A. R. Stammers and Mr P G Bevan of Birmingham Dr J E M Wigley Dr H W Barber Sir Cecil P G Wakeley *K B E., C B* Dr Neville Southwell and Mr F B Cockett of London Dr H M Walker and Dr J Ungar of Glaxo Laboratories Dr S Braham of Leeds Dr Gerald H Pratt of New York Dr F Martorell of Barcelona Dr E. J Orbach of America Dr Gunnar Bauer of Sweden Dr R Tournay of Paris Professor E. S J King and Dr Harold Moore of Melbourne Dr W Wayne Babcock of Philadelphia Mr Bernard Catchpole of Manchester the Photographic Departments of Charing Cross Hospital Westminster Hospital Guy's Hospital St. Bartholomew's Hospital, Southend General Hospital, St John's Hospital for Diseases of the Skin and Messrs. Ilford the Wellcome Historical Medical Museum the Armed Forces Medical Library Washington, D C. Messrs. Charles F Thackray Messrs. John Bell & Croyden The Scholl Manufacturing Company Messrs Smith & Nephew Messrs. Lastonet Products Sharp and Dohme Ltd. L. C. Caswell, L. Field Marchant, H. S Edwards, Miss C. Lamb S Garbutt, and Mr Derek Stewart of Messrs Simpl Ltd also Miss P M Turnbull of Charing Cross Hospital Photographic Department, for advice on photography In particular we are grateful to Mr John Wood of the Southend General Hospital Photographic Department for many of the new pictures

I should also like to express my grateful thanks to those surgeons and physicians who throughout my travels in Canada the United States of America, France, Sweden, Denmark, Spain, Switzerland and Italy have all helped and taught me so much. In particular I remember with gratitude Robert Linton of Boston, Donald Baker of West Roxbury and Slemon Luke and Bigelow of Canada.

CONTENTS

LIST OF ILLUSTRATIONS

Diagrams of Surgical Operations on Varicose Limbs

FIGURE PAGE

Chapter 9 —Treatment by Conservative Measures

Chapter 10 —Treatment by Sclerosant Injections

Chapter 11 —Treatment of Surgical Failures

Chapter 12 —" Varicose " Ulceration, Haemorrhage

Chapter 13 —Superficial Thrombophlebitis

Chapter 14 —Deep Venous Thrombophlebitis, Pulmonary Embolism and Anti-coagulant Therapy

Chapter 15 —Venous Ulcers—Their Cause and Diagnosis

Chapter 16—Treatment of the Indurated and Ulcerated Leg by Conservative Measures

LIST OF COLOURED PLATES



300 years ago Severinus wrote as follows "I have seen ulcers of 2, 4, 7, and nay, even 10 years' standing heal up completely after the surrounding varicose veins had been successfully removed—the ulcers disappear just like plants which are drying up when a brook is diverted"

CHAPTER 1

INCIDENCE AND AETIOLOGY OF THE VARIX THE VARIX AS A NATIONAL PROBLEM

INCIDENCE

THE INCIDENCE of varices and their complications is not only an individual but also a national problem of great importance Many man hours are lost in industry owing to the complications of varicose veins As an example we are told by Curwen and Scott (1952) that in the United States of America 5 900 000 days work were lost in the course of one year Evidence of this nature should make us realize the effect of this disease on the economy of the nation and yet it is only in a few hospitals that we find adequate clinics and facilities for the proper segregation and treatment of the sufferer from varicose veins

It is difficult to obtain accurate information regarding the frequency of the occurrence of varicose veins in the various races but it is of interest to note that in Keen s *Surgery* (1909) the statement is made that negroes Indians Mexicans and Chinese suffer from this condition far less frequently than do the white races It is difficult to surmise why this should happen unless it be that those who live in the more torrid climates are less likely to spend as long standing as do the Nordic races

Another point of interest is the relative frequency of the disease among men and women In *Survey of Sickness* 1943–1945 prepared for the Ministry of Health by Patrick Slater it was stated that of those suffering from varicose veins 27 23 per cent were males and 72 77 per cent were females This finding agrees with the majority of researches into this question Pregnancy puberty and the menopause with the endocrine disturbances associated with them doubtless have something to do with this finding. Berntsen (1927) and at a different time McPheeters and Anderson (1939) are in agreement regarding the sex ratio They found that the incidence in both sexes was apparently equal up to the twentieth year Between the ages of 20 and 30 years the ratio was three women to one man between 30 and 40 years of age the ratio was four women to one man Women attend in far greater numbers at the average clinic than do men but since they are far more prone to attend for cosmetic reasons this gives rise to a general impression with the laity that varices are essentially a disease of the female.

Varicose veins may be found in almost every part of the body (Nicholson 1923) The frequency of their appearance in the legs may make us forget this fact. This receives notice under the aetiological section of this chapter since it has a distinct bearing on the causation of varices In other words they may occur in the absence of a mechanical factor

Statistical surveys of the incidence of varices are extremely variable A few quotations from accepted experts, however will help to show the extreme prevalence of the condition

Meisen (1937) found that 17 per cent of a group of conscripts in Denmark were suffering from varices of some degree. De Takáts (1930) quotes the result of an

cause. The author later refers to the varied causes as varicose factors and suggests that in the early stages one of the most important of these might well be found in the complexities of the ductless glands. It is not until recently however that the matter has been further clarified by the excellent work of Professor E. S. J. King of Melbourne University in his article The Genesis of Varicose Veins (1950). He approaches the whole subject from a new and most interesting angle. Put briefly, he feels that there are two quite distinct stages in the production of the varix. He speaks of *the primary and the secondary aetiological factors* and feels that investigators have concentrated too much on the secondary or late aetiological causation and too little on the early stages of the disease. In other words it is no use studying the long established varix, showing the typical signs of thrombosis, calcification, valvular atrophy, elongation and tortuosity. He shows us that long before these changes occur in the veins there are definite histological alterations which are constant in the very early stage of varicosis. It will be necessary in this chapter to quote extensively from his work but even so the reader is advised to study his paper in its entirety.

King feels strongly that the early stage of varicose veins is a haemodynamic problem and that the changes are probably due to a chemical, possibly a hormone or hormones of the oestrogen group. He supports the haemodynamic theory as follows.

(1) Varicose veins usually make their first appearance as a localized, sharply circumscribed group communicating with veins which are of normal calibre. Such groups of varices may communicate with a perfectly normal saphenous vein in which there is no valvular incompetency.

(2) The early varix is dilated and has a thickened muscular wall. There is no atrophy or sacculation as is found in the later stage of the varix.

(3) At an early stage there is a swelling of the vein, which is distal and not proximal to the valve. The position of this dilatation cannot be explained by the theory of back-pressure. Ledderhose (1906 and 1908) also made this observation.

(4) Pulsation is frequently present in these veins and since the valves are still competent this is not due to a back pulsation through the proximal vein. This point can be proved by testing and compressing the main vein. These observations were also made by Ledderhose and Hasebrök (1916).

(5) The blood in the early varix has a high oxygen content. The blood in the established gerontic varix contains but little oxygen. This finding emphasizes the fact that there are two stages in the formation of the mature varix.

(6) In the early stages of the varix the process is reversible. Prominent veins may cease to be evident though there may have been no mechanical alteration. This point has been noted by the author of this manual on several occasions and was particularly noticeable in a girl of 13 years of age, whose severe varices disappeared after the establishment of her periods.

(7) From the histological angle, the veins are thickened showing hypertrophy of the muscle coat. Also the most important feature of *vascularity of the adventitia is present*. This is confined to the site of the varicosity only which is a point of considerable importance (Plate I, *b* and *c*).

(8) Varicose veins are to be found in almost every part of the body (Nicholson, 1923). In many of the positions in which they occur no mechanical factor can possibly come into play.

These eight facts point out that neither congenital, morphological nor hydrostatic hypotheses can account for the early stage of the varix On the other hand, as King says, it may well be explained on a haemodynamic basis In other words, *although the simple mechanical explanation of their causation by means of back-pressure is ruled out, it is shown that an increased amount of blood is in the vein and the origin of this blood is distal rather than proximal*

King then gives us a most careful analysis of the work of the investigators in the past, who explained why this increased blood flow and dilatation of the veins occurred He quotes Richard Lower (1669), who said "It is an undisputed fact that the return of the venous blood is the result of the impulse given by the arterial blood and not of any attraction of the heart" Again he discusses the work of King (1837) who noted centripetal pulsation of the veins As far back as 1707 Lealis Leal had already noted that there were in some places definite communications between the arteries and veins These communications were larger than the capillaries In pathological conditions these anastomoses become more extensive in distribution than under normal conditions By way of further evidence Quincke (1868) and Jurgensen (1920) noted that the pulsation observed in veins was due to the rapid passage of blood from the arteries through arterio-venous anastomoses Such pulsation must, under certain circumstances, be due to the *dilatation of capillaries,* whose increased diameter would then allow the blood to pass through easily *It is in the causation of the relaxation of these minute vessels that the primary aetiological factor of varices lies* A corollary may be found in the development of increased blood flow with visible pulsation in the efferent veins of the salivary glands when an increased flow of saliva is produced by the stimulation of the chorda tympani, an observation made by Claude Bernard (1858) The presence of arterio-venous shunts is discussed in the chapter on venous circulation (Chapter 4) It is in the *cause* of these shunts that King is so interested

Taking all these findings into consideration it is clear that *the vascular changes are not due to a simple mechanical back-pressure, but to some stimulus affecting the local conditions of the vessel walls and of the blood flow* The immediate stimulus appears to be one of a chemical nature and there is evidence that this chemical substance may well be a hormone or hormones of the oestrogen group The evidence that this is so may be summarized as follows

(1) It is accepted that telangiectases, also known as sky-rockets, or spider-bursts, are definitely associated with an oestrogen excess Their appearance at the menopause or at any time of endocrine disturbance is well known

(2) Telangiectases also make themselves evident in patients whose liver dysfunction causes the failure to metabolize oestrogens and to destroy them which is usual (Glass *et al* 1940)

(3) Bean (1945) produced telangiectases in those who were given oestrogens therapeutically

(4) The oestrogens affect the smooth muscle in many other organs of the body and there is no reason why they should not have a similar action on the smooth muscle of the veins Clauberg (1938) demonstrated the dilatation of the Fallopian tube after giving oestrogens Hundley *et al* (1942) showed that oestrogens had a similar action on the ureter in early pregnancy Burrows and Kennaway (1934) and Lacassagne

PLATE I



(a)

Scar tissue obstructing the trunk of the internal saphenous vein in a young girl. Varices have developed around the scar but are absent elsewhere. This picture demonstrates one of the factors in the causation of varices—that of back pressure from obstruction (*see also* Fig. 1)



(b)

Photomicrograph of a section from a varicose area, showing prominence of small vessels. The "active" change in the vessel is indicated by the presence in such a small vessel of vasa vasorum, especially in the vessel in the lower part of the photograph



(c)

Photomicrograph of a section of a varicose vein in the middle part of the thigh. There are numerous small vessels in its wall and in the neighbourhood indicating general active vascular change.

[Facing page 4

(1933) found that large doses of oestrogens caused a distension of the urinary bladder when injected into mice

(5) Frequently in pregnancy before the factors of congestion and pressure have been brought into play varices appear and increase considerably

(6) Aguero (1946) treated patients suffering from varices with oestrogen He noted symptomatic improvement

Only a few of the interesting researches of King into the early stages of varices have been given but in his own words he states that the general importance of the members of the oestrogen groups as influencing smooth muscle tone in some parts of the body is adequately demonstrated and that when all the phenomena are considered we are presented with an hypothesis arising directly out of them Varicose veins are to be considered in two stages which are separable but not necessarily related Summarizing he further states in the early stages there is a disturbance of the vascular relationships in an area resulting in an increased arterio-venous blood flow This is associated with relaxation of the vessel walls not only of the arterio-venous communicating vessels but in the veins themselves This gives the greater blood flow in the veins with the centripetal pulse the oxygenated blood the dilatation just distal to the valves the reversibility (if the chemical conditions alter) and the histological appearances of the distended and numerous capillaries. It accounts for the localization of the condition with normal vessels to be seen proximal to the affected area

To show how interesting a study of the incidence and aetiology may be I would like to give an extract from a personal letter from Arnoldi (1957) which reads as follows

" In a very short time I shall have finished the collection of facts for the genetic study of varicose disease.

The results bring out a few interesting facts —

(1) The occurrence of varicose veins in the population over 25 is about 20–25 p c

(2) 1–2 p.c. of the same population either have or have had varicose ulcers

(3) Varicose veins seem to be an inherited disease on the dominant pattern but the manifestation is uncertain and depends on other factors One of these factors is hormonal

(a) in a sibship generally only the daughters with the highest menarche age get varicose veins

(b) even a double inheritance of varicosities can be suppressed if marriage takes place into a family with a very early menarche age

(4) In one hundred cases of ulcer cruris not one was found *in a family* without varicose veins. The average menarche age was very high in ulcer families as a whole

(This I find very interesting as the modern trend is to disregard varicose veins as an ulcer factor and regard them all as post thrombotic cf Bauer etc.)

No doubt a number of these ulcers are post thrombotic, but then it seems as if *the tendency to thrombo-embolic disease of the deep veins is more pronounced in varicose-infested families* than in families without varicosities.

It might be explained quite simply that all veins of the leg—deep as well as subcutaneous—are influenced by the same hormonal factors which are indicated by the close correlation between the age of menarche and varicosities (cf the late average menarche age in the ulcer families)

Further it would seem as if this hormonal influence tends to render the veins more prone to thrombosis.

The few facts given above emphasize the importance of this subject as far as the national point of view is concerned Some suggestions towards the remedy of the situation are given in the chapter on general principles of treatment (Chapter 7)

Secondary aetiological factors

Having given a brief review of this fascinating research of Professor King, we may now turn to the secondary aetiological factors, which may become added to the primary condition as already described

(1) The erect stance of the human as opposed to that of the quadruped

(2) The hereditary factor

(3) Pregnancy

(4) Changes resulting from the inflammation of the veins and their valves

The above are the main secondary or late factors in the production of the varix, although numerous other causations have been discussed by many writers These range from vitamin deficiency to allergy, but in the opinion of the author have not sufficient supportive evidence to be worth our consideration at present

It is now proposed to take the secondary factors in the order enumerated

The erect stance of the human as opposed to that of the quadruped

The erect stance of the human is a factor in the causation of the varix which finds support in the papers of many writers, and is well expressed by Eger and Caspar (1943) These investigators dissected 38 adult cadavers in order to investigate the valvular distribution in the external iliac and femoral veins proximal to the orifice of the internal saphenous vein

Their hypothesis was that, since there are no valves in the inferior vena cava and common iliac veins, the valves in the external iliac veins have to support the column of blood when standing The absence of valves in these external iliac veins imposes a further weight on the valves of the femoral veins An even greater weight is imposed on the internal saphenous vein by the absence of valves in both the external iliac and femoral veins

There is no doubt that one of the important aetiological factors in the causation of varices is the retrograde hydrostatic pressure due to the prolonged effect of gravity, which has not been adequately opposed by the activity of the leg muscles For this reason those engaged in occupations involving prolonged standing are the most frequent sufferers Policemen, waiters and nurses are all suitable candidates for the development of varices

Clinically, varicose veins are not uncommonly found in those who are engaged in work involving a maximum effort spread over a short period of time Such patients may be athletes, furniture movers, weight lifters and so on, and their exertions cause sudden compression of the abdominal contents, which in turn gives rise to sudden raising of the pressure in the veins of the lower extremities It is of interest to note that these sudden strains have an effect on the unsupported superficial veins whereas the deep veins surrounded by muscle and fascia are not affected to the same degree It may be observed quite frequently that the top, poorly supported, portion of the saphenous vein is affected by this irregular elevation of pressure whereas the vein lower down the leg remains unaffected

Such cases present a rounded swelling at the sapheno-femoral junction which is described as a sapheno-varix This swelling may resemble that produced by a femoral hernia. This type of saccular swelling in the first segment of the long saphenous vein has a form of stress applied to it different from that applied to the vein of the lower leg which develops varicosities as a response to gravitational causes.

No example of varices occurring in any quadruped can be traced by the author, who has made exhaustive inquiries regarding this point and has been unable to find a single instance of any four legged animal suffering from a varicose vein although it was reported that a donkey which died some time ago at the London Zoo had suffered from this condition. Adequate confirmation of this point was however lacking.

This fact emphasizes the great importance of the erect stance as a factor in the causation of varices



Fig 1 —A varix developing after trauma. The circular scar was caused by a burn. Within a few years a large localized varix appeared around the scar The patient had no other evidence of varices, and it is supposed that the scar tissue was a determining factor in the production of this varix.

since the others discussed in this chapter can affect both the quadruped and the biped. Dr Reginald Lovell in a personal communication to the author suggests that possibly an additional factor in the absence of varices in the quadruped may be that the superficial veins in many animals receive a firmer support from the superficial fascia than occurs in the human In this connexion Wagner and Herbut (1949) offer us an interesting sidelight on the possible reasons for the rarity of veins appearing before puberty They point out that the hydrostatic pressure reaches its maximum only when full height has been obtained Furthermore, the elasticity of the skin and veins is greatest during this period and the diameter of the veins relatively smaller Muscular movements are more active and more constant, thus increasing the return flow of the blood and encouraging drainage of the superficial veins The veins are still growing in length and occupations involving protracted periods of standing are seldom required Although the theories of these writers are most interesting, it is likely that the endocrine factor plays a more important part at this state of varicosis

There is no doubt that a traumatic factor is present in the production of small localized groups of varices. For example, the author has frequently noted that those addicted to horse riding sometimes develop a bunch of varices over the knee

This is produced by the localized pressure on the internal saphenous vein from gripping the saddle between the knees This is a fairly common example of local trauma causing the development of varices and may be looked upon as an occupational disease

The hereditary factor

The majority of patients preface their requests for treatment with the remark that one or other of their parents was a sufferer Magnus (1921) found that somewhere between 50 and 75 per cent of his varicose patients gave a history of an hereditary factor De Takats and Quint (1930) agreed with Magnus in their findings It is possible that heredity conveys a tendency towards the formation of varices, but does not pass the condition on from parent to child as a transmissible characteristic This theory is supported by the fact that it takes other factors in addition to the hereditary tendency to form a varix There are those of us who feel that owing to the commonness of the condition, family incidence would be bound to make itself evident King (1950) states that he has not been able to demonstrate any hereditary influence of statistical importance As previously stated, however, the author is satisfied that the hereditary factor is one of importance and in a letter to the *British Medical Journal* (1950) he calls attention to the fact that not only is the hereditary tendency present, but it is not uncommon to see the same pattern of varices transferred from parent to child Again, not only may the pattern be transferred, but the type of vein itself may run in families For example, " hair veins " or " athletic veins " may often occur in successive generations Furthermore, Anning, in a personal communication to the author, speaks of two families in which the varicose veins are limited to the right side in one family and to the left in the other On analysing the hereditary factor in 525 patients he (Anning, 1950) found that 51 per cent had a definite family history of varicose veins and varicose ulceration Even having regard to the prevalence of varicose veins in the general population, figures such as these certainly support the view that heredity does indeed play a part as a factor in the causation of this disease

Further observations on the congenital and hereditary angle are offered to us by Wagner and Herbut (1949), who, after the histological examination of one hundred veins at the sapheno-femoral junction, came to the following conclusions

(1) The absence of smooth muscle and of internal elastic membrane in the sinus walls of the great saphenous vein in the valve area at the sapheno-femoral junction is common

(2) This defect may be congenital and possibly hereditary

(3) It is possible that such defects in other perforator veins would predispose to dilatation under the constant stress of haemodynamic force, rendering the corresponding valves functionally incompetent and permitting the retrograde flow of blood from the deep into the superficial veins Granted that a certain degree of thinning of the venous wall at the sinus area is normal, it must be conceded that there are limits beyond which the conditions must be regarded as definitely abnormal

By way of comment we must realize that to presuppose that these defects are either congenital or hereditary in origin is purely speculative, and we have no real support for this assumption

Pregnancy

Pregnancy as a factor in the causation of varices has received considerable investigation by many workers Extensive tests on the popliteal venous pressures have been carried out by Veal and Hussey (1941) whose investigations show that the pressure of the uterus on the pelvic veins is a definite factor in their origin Those interested should read their article from which their summary and conclusions are given as follows

(1) The assumption that postural dependent edema and varicose veins of the lower extremities in pregnant women are due to localized obstruction of the deep veins is supported by the types of pressure curve obtained when popliteal venous pressures are recorded during exercise

(2) The factors responsible for increasing the degree of localized venous obstruction in some pregnant women to the point of causing edema or varicose veins or both are not perfectly understood The size and position of the uterus are factors of recognized importance.

(3) In pregnant women manifesting significant obstruction of the femoro-iliac veins provision of adequate support for the superficial veins by means of elastic stockings minimizes or prevents the development of varicose veins "

The mechanical effect of a pregnancy in increasing venous pressure may be explained by the following mechanism described by Barcroft and Rothschild (1932) They stated the theory that venous engorgement of the iliac veins is caused by an increase of blood received from the uterine and ovarian tributaries during pregnancy This great increase of blood received into the iliac vessels may render the channel for the blood received from the veins in the leg inadequate In this way a back pressure effect may be transmitted to the veins of the leg. This theory may explain in part the rapid development of varices sometimes seen early in pregnancy before the effect of a pelvic tumour comes into play The endocrine factor in early pregnancy has already been mentioned, and doubtless has an effect at the same time



FIG 2.—A bunch of varices associated with the external saphenous vein in a girl of 13 years in the prepuberty stage of life It is not well demonstrated in this photograph but is merely shown for its rarity since such cases before the onset of menstruation are extremely uncommon

McAusland (1943) emphasizes the evidence of the association of hormones in the aetiology of varices He points out that pregnant women suffering from severe varicosities are less likely to abort than are those who are free from varices Furthermore he noted that women with severe varicose veins were more likely to show abnormal endocrinal features such as abnormal hair distribution, altered menstrual histories and abnormal body build Again he comments

upon the frequency of the development of severe varices during pregnancy These findings of McAusland are further supportive evidence for the primary aetiological factor of endocrinal origin discussed by King (1950), and at this stage it is of interest for us to note the connexion of varices with puberty De Takàts and Quint (1930) noted the incidence of varicose veins at puberty in 20 per cent of their cases Sicard and Gaugier (1931), Kramer (1898), Delater (1927), Gaugier (1926), and Fischer (1904), amongst many other authors, have also called attention to this fact, which again is evidence of the effect which the endocrines may have on the incidence of varices

In 1947, the author endeavoured to correlate the changes in varices which occur both in early pregnancy as well as in the premenstrual phase, feeling that there was the same basic hormonal influence at work in the production of these most similar conditions His letter to the *Lancet* stated that: " Further information is required about the influence of hormones on varices The fact that varices tend to swell at puberty, during menstruation, in early pregnancy, and at the menopause is accepted During the premenstrual phase every woman is in a state of pseudo-pregnancy, and one may regard the menstrual flow as a miscarriage of the unfertilized ovum The enlargement of varices in the premenstrual phase and in the early days of pregnancy may therefore be accounted for by the same hormonal influence " In the past 13 years since this statement was made it is of interest to see how much support has been lent to it by King's research

For those who are interested in the experimental value of oestrogen therapy in the treatment of varices the article by McPheeters (1949) is most helpful

Changes resulting from the inflammation of the veins and their valves

The question of whether damage to the valves of the superficial veins caused by inflammation precedes the varicosities or whether the valves become destroyed as a result of the tortuosities and dilatations of the varicosities has been debated by many authors Superficial thrombophlebitis as a cause of varices is obviously rare, and it is far more probable that phlebitic changes occur in veins which are already becoming varicose

SUMMARY

There is no doubt that there is considerable room for research and thought into the pathogenesis of varicose vein disease At present in the field of therapy we have to confine ourselves to diseased vessels The prevention of this condition by the elimination of some of the factors causing it is something which is worth the consideration of investigators It is to be hoped that when adequate clinics are provided for treatment, research will be stimulated in these departments

Meanwhile, the work of Professor King is a fitting protest against the current attitude of self-satisfaction in the question of the causation of varices His paper, which calls our attention to this early or primary stage of varicosis, should stimulate our endeavours to explore the hormonal or endocrinal angle on this subject It is in this early stage of the varix, before the secondary and well-recognized changes occur, that the secret of their causation may well lie In the meantime, we must realize that no one single causation is likely and that various factors assist each other in causing the varix as we all know it

Briefly the following factors in the causation of varices must receive our consideration It is possible that the endocrinological factor may well be considered as a primary cause and that the other factors may indeed be secondary

(1) Endocrinological factors
(2) The erect stance
(3) The hereditary factor
(4) Pregnancy
(5) Thrombosis of the deep veins

Varicose veins from the medico-legal angle

From the practical point of view the question of the causation of varicose veins or of their aggravation frequently arises over the question of a pension after war service The case of Wallbridge v Minister of Pensions (*Lancet*, 1950) throws light on the accepted view regarding the liability of the State when varicose veins develop during or after service. In this case the appellant passed into the Service as Grade I with no record of any previous varicose condition His service consisted mainly in plotting the position of aircraft and varicose veins developed during this time. He was awarded a pension on the basis that the condition was aggravated by but not attributable to war service. The consensus of medical authority was that varicose veins were related to a congenital and inherited weakness of the walls of the veins and to a deficiency of their valves. Service conditions would not produce varicose veins and walking or marching as such, was an advantage rather than a detriment. In summing up the Judge stated that it was difficult for a Tribunal to hold the varicose veins attributable to war service unless there was some evidence of a supervening cause other than the ordinary conditions of war service. In the absence of such supervening cause ordinary service conditions could not be regarded as causing varicose veins although they might aggravate the disability Having regard to our present knowledge of the aetiology of varices this ruling appears to be eminently fair If a man were admitted to the service, however with signs of deep vein insufficiency prolonged standing would undoubtedly tend to cause further complications and his service might well be looked upon as being a direct factor in the causation of his ulcer With our present knowledge it is obvious that we should advise our patients to avoid the selection of employment which entails prolonged standing.

The varix as a National problem

In my book on the *Physical Treatment of Varicose Ulcers* (1958) I have tried to summarize the manner in which we can reduce the army of sufferers by the most economic methods I feel I cannot do better than to quote verbatim

"(1) All Hospitals should have a specialized department for the treatment of varicose disease and ulceration

(2) These departments should be under a surgeon prepared to give the necessary time to the speciality

(3) Continuity of administration as far as a surgical appointment is concerned is essential. So often the junior surgeon in charge of a department is apt to leave it for more glamorous fields such as cardiac or gastric surgery When it is not possible to employ one who has devoted his full time to varicose disease the department should be in charge of a general surgeon who is prepared to give much of his time, and is also prepared to ensure that his juniors truly specialize in the subject.

upon the frequency of the development of severe varices during pregnancy. These findings of McAusland are further supportive evidence for the primary aetiological factor of endocrinal origin discussed by King (1950), and at this stage it is of interest for us to note the connexion of varices with puberty. De Takàts and Quint (1930) noted the incidence of varicose veins at puberty in 20 per cent of their cases. Sicard and Gaugier (1931), Kramer (1898), Delater (1927), Gaugier (1926), and Fischer (1904), amongst many other authors, have also called attention to this fact, which again is evidence of the effect which the endocrines may have on the incidence of varices.

In 1947, the author endeavoured to correlate the changes in varices which occur both in early pregnancy as well as in the premenstrual phase, feeling that there was the same basic hormonal influence at work in the production of these most similar conditions. His letter to the *Lancet* stated that "Further information is required about the influence of hormones on varices. The fact that varices tend to swell at puberty, during menstruation, in early pregnancy, and at the menopause is accepted. During the premenstrual phase every woman is in a state of pseudo-pregnancy, and one may regard the menstrual flow as a miscarriage of the unfertilized ovum. The enlargement of varices in the premenstrual phase and in the early days of pregnancy may therefore be accounted for by the same hormonal influence." In the past 13 years since this statement was made it is of interest to see how much support has been lent to it by King's research.

For those who are interested in the experimental value of oestrogen therapy in the treatment of varices the article by McPheeters (1949) is most helpful.

Changes resulting from the inflammation of the veins and their valves

The question of whether damage to the valves of the superficial veins caused by inflammation precedes the varicosities or whether the valves become destroyed as a result of the tortuosities and dilatations of the varicosities has been debated by many authors. Superficial thrombophlebitis as a cause of varices is obviously rare, and it is far more probable that phlebitic changes occur in veins which are already becoming varicose.

SUMMARY

There is no doubt that there is considerable room for research and thought into the pathogenesis of varicose vein disease. At present in the field of therapy we have to confine ourselves to diseased vessels. The prevention of this condition by the elimination of some of the factors causing it is something which is worth the consideration of investigators. It is to be hoped that when adequate clinics are provided for treatment, research will be stimulated in these departments.

Meanwhile, the work of Professor King is a fitting protest against the current attitude of self-satisfaction in the question of the causation of varices. His paper, which calls our attention to this early or primary stage of varicosis, should stimulate our endeavours to explore the hormonal or endocrinal angle on this subject. It is in this early stage of the varix, before the secondary and well-recognized changes occur, that the secret of their causation may well lie. In the meantime, we must realize that no one single causation is likely and that various factors assist each other in causing the varix as we all know it.

Briefly the following factors in the causation of varices must receive our consideration It is possible that the endocrinological factor may well be considered as a primary cause and that the other factors may indeed be secondary

(1) Endocrinological factors
(2) The erect stance
(3) The hereditary factor
(4) Pregnancy
(5) Thrombosis of the deep veins

Varicose veins from the medico-legal angle

From the practical point of view the question of the causation of varicose veins or of their aggravation frequently arises over the question of a pension after war service. The case of Wallbridge v Minister of Pensions (*Lancet* 1950) throws light on the accepted view regarding the liability of the State when varicose veins develop during or after service. In this case the appellant passed into the Service as Grade I with no record of any previous varicose condition His service consisted mainly in plotting the position of aircraft and varicose veins developed during this time. He was awarded a pension on the basis that the condition was aggravated by but not attributable to war service. The consensus of medical authority was that varicose veins were related to a congenital and inherited weakness of the walls of the veins and to a deficiency of their valves Service conditions would not produce varicose veins and walking or marching as such was an advantage rather than a detriment. In summing up the Judge stated that it was difficult for a Tribunal to hold the varicose veins attributable to war service unless there was some evidence of a supervening cause other than the ordinary conditions of war service. In the absence of such supervening cause ordinary service conditions could not be regarded as causing varicose veins although they might aggravate the disability Having regard to our present knowledge of the aetiology of varices this ruling appears to be eminently fair If a man were admitted to the service, however with signs of deep vein insufficiency prolonged standing would undoubtedly tend to cause further complications and his service might well be looked upon as being a direct factor in the causation of his ulcer With our present knowledge it is obvious that we should advise our patients to avoid the selection of employment which entails prolonged standing.

The varix as a National problem

In my book on the *Physical Treatment of Varicose Ulcers* (1958) I have tried to summarize the manner in which we can reduce the army of sufferers by the most economic methods I feel I cannot do better than to quote verbatim

"(1) All Hospitals should have a specialized department for the treatment of varicose disease and ulceration.

(2) These departments should be under a surgeon prepared to give the necessary time to the speciality

(3) Continuity of administration as far as a surgical appointment is concerned is essential. So often the junior surgeon in charge of a department is apt to leave it for more glamorous fields such as cardiac or gastric surgery When it is not possible to employ one who has devoted his full time to varicose disease the department should be in charge of a general surgeon who is prepared to give much of his time and is also prepared to ensure that his juniors truly specialize in the subject.

(4) Ulcerated limbs should be treated by means of compressive bandages in the *early stages*, until healing has either completely or almost taken place

(5) The valuable help of the physiotherapist should be made available to all sufferers *at the right time* in the course of healing of the ulcer This question of proper timing for asking for the help of the masseuse is of importance, not only from the patient s angle but also from the economic angle

(6) The public should be made more aware by propaganda of the advantages of treatment

(7) The general practitioner should be encouraged to attend our clinics So much of the treatment by compression bandages could be done by him—and so relieve the congestion in our out-patient departments "

BIBLIOGRAPHY AND REFERENCES

Aguero, O (1946) " Várices y estrogenos " *Rev Obstet Ginec* , 6, 155

Anning, S T (1950) " Heredity and Leg Ulcers " *Brit med J* , 2, 1305

Arnoldi, C (1957) Personal correspondence

Barcroft, J , and Rothschild, P (1932) " The Volume of Blood in the Uterus during Pregnancy " *J Physiol* , 76, 447

— Herkel, W , and Hill, S (1933) " The Rate of Blood Flow and Caseous Metabolism of the Uterus during Pregnancy ' *J Physiol* , 77, 194

Bean, W B (1945) ' The Cutaneous Arterial Spider ' *Medicine*, 24, 243

Bernard, Claude (1858) " Sur une Experience Relative a l'influence que les Nerfs Exercent aux Phenomênes de Circulation " *C R Soc Biol , Paris*, 5, 29

Berntsen, A (1927) " Des Varices du Membre Inferieur " *Acta chir scand* , 62, 61

Birger, I (1941) " Ulcers Crurise-atiologi-tarapi ' *Nord med* , 10, 1240

Burrows H , and Kennaway, N M (1934) " On some Effects Produced by Applying Oestrin to the Skin of Mice ' *Amer J Cancer*, 20, 48

Clauberg, C (1938) " Künstlich erzeugtes Tubemuachstum ein mit belingender Faktor bei der Behelung von sterilitat durch Follikelharmon " *Zbl Gynak* , 62, 1034

Curwen, I H M , and Scott, B O (1952) " The Ambulant Treatment of Complications Resulting from Varicose Veins and Allied Conditions " *Ann Phys Med Lond* , 1, 17

Delater, G (1927) " Pathogeny of Varicose Veins " *Irish J med Sci* , 6, 199

Duguid, J B (1951) " The Aetiology and Pathogenesis of Varicose Veins " *Practitioner*, 166, 223

Eger S A , and Caspar, S L (1943) " Etiology of Varicose Veins from an Anatomic Aspect " *J Amer med Ass* , 123, 148

Fischer, B (1904) ' Die Pathogenese der Phlebektasie " *Arch Derm Syph , Wien*, 70, 195

Foote, R R (1946) " Varicose Veins ' (Letter) *Brit med J* , 2, 680

— (1947) " Varicose Veins ' *Lancet*, 1, 83

— (1950) " Heredity and Leg Ulcers " (Letter) *Brit med J* , 2, 1495

— (1958) *Physical Treatment of Varicose Ulcers* Edinburgh, Livingstone

Gaugier L (1926) " L'Étiologie des Varices ' *Pr med* , 2, 1442

Glass S J Edmondson, H A , and Soll S N (1940) " Sex Hormone Changes Associated with Liver Disease *Endocrinology*, 27, 749

Hischrol K (1916) Eine physchalisch-experimentell begrundete neue Aufferung der Pathogenese der varicen ' *Dtsch Z Chir* , 136, 381

— (1916 ' Ueber die Bedentung der arterien pulsationen fur die Stromung in den Venen und die Pathogenese der Varicen ' *Pflug Arch ges Physiol* , 163 191

Hundley J M , Jr Diehl W K , and Diggs, F S (1942) ' Hormonal Influences upon the Ureter " *Amer J Obstet Gynec* 44 858

Jurgensen I (1920) Mikrokapillarbeobachtungen *Dtsch Arch klin Med* , 132, 204

Keen W W (1909) *Surgery* 4 1149 Philadelphia, Saunders

Kin I S J (1950) The Genesis of Varicose Veins ' *Aust N Z J Surg* , 20 126

King I W (1837) ' The Safety Valve Function of the Right Ventricle of the Human Heart ' *Guy s Hosp Rep* 2 104

Kramer C. (1898) "Ueber die Aetiologie und die chirurgische Therapie (insbesondere die Radikaloperation) der Varicen an der unteren Extremitäten." *Münch med Wschr.*, 45 1206.
Lacassagne, A. (1933) Metaplasie Epidermoide Provoquée par les Injections de Folliculine *C R. Soc Biol., Paris* 113 590
Lancet (1950) Varicose Veins and Military Service." *Lancet* 2, 7
Larson, R. A and Smith, F L. (1943) Varicose Veins." *Proc Mayo Clin* 18 400
Lealis Leal (1707) *Exercitato epistalica.*
Ledderhose, G (1906) "Studien über den Blutlauf in der Hautvenen unter Physiologischen und Pathologischen Bedingungen *Mitt Grenzgeb Med Chir.*, 15 355
— (1908) *Ibid* 18 quoted by Rost, F (1920) "Pathologische Physiologie des Chirurgiens (Experimentelle Chirurgie) Leipzig F C W Vogel
Lower R. (1669) *Tractatus de Corde item de Motu et Colore Sanguinis et Chyli in eum Transitu* p 133 London James Allestry
McAusland, A M (1943) "Pregnancy in Association with Severe Varicose Veins." *West J Surg.*, 51 199
McPheeters, H O (1949) The Value of Oestrogen Therapy in the Treatment of Varicose Veins Complicating Pregnancy" *Lancet* 69 2.
— and Anderson, J K. (1939) *The Injection Treatment of Varicose Veins* 2nd ed. Philadelphia Davis.
Magnus, G (1921) Zirkulationsverhältnisse in Varicen" *Dtsch Z Chir* 162, 71
Meisen, V (1937) *Varicose Veins and Hemorrhoids* p 140 Springfield, Ill Thomas
Ministry of Health (1946) "On the State of the Public Health during Six Years of War" *Rep med Offr Ministr Hlth London.*
Moore, H D (1951) "Deep Venous Valves in the Aetiology of Varicose Veins." *Lancet* 2 7
Nicholson, B B (1923) "Histopathology and Aetiology of Varicose Veins." *Arch Surg., Lond* 7 47
Quincke, H. (1868) Beobachtungen über Capillar und Venenpuls." *Berl klin Wschr.*, 5 357
Sicard, J A., and Gaugier L. (1931) *Le Traitement des Varices par les Injections Locales Sclerosantes*, 3rd ed. Paris Masson
Slater P (1946) *Survey of Sickness October 1943 to December 1945* A Report of a Series of Surveys on the State of Health of the Civilian Population between these dates made for the Ministry of Health. London H M.S O
de Takáts, G., and Quint H (1930) "The Injection Treatment of Varicose Veins" *Surg Gynec Obstet* 50 545
Turnbull, J A (1945) Allergy as a Factor in Surface Ulcers and Varicose Veins, Phlebitis and Thrombosis." *Amer J digest Dis* 12, 272.
Veal, J R., and Hussey H H (1941) "The Venous Circulation in the Lower Extremities during Pregnancy" *Surg Gynec Obstet* 72, 841
Wagner F B and Herbut, P A (1949) "Etiology of Primary Varicose Veins." *Amer J Surg* 78 876
Wolf G (1941) *Praxis* 36 41

(4) Ulcerated limbs should be treated by means of compressive bandages in the *early stages*, until healing has either completely or almost taken place

(5) The valuable help of the physiotherapist should be made available to all sufferers *at the right time* in the course of healing of the ulcer This question of proper timing for asking for the help of the masseuse is of importance, not only from the patient's angle, but also from the economic angle

(6) The public should be made more aware by propaganda of the advantages of treatment

(7) The general practitioner should be encouraged to attend our clinics So much of the treatment by compression bandages could be done by him—and so relieve the congestion in our out-patient departments "

BIBLIOGRAPHY AND REFERENCES

Aguero, O (1946) " Varices y estrogenos " *Rev Obstet Ginec*, 6, 155

Anning, S T (1950) " Heredity and Leg Ulcers " *Brit med J*, 2, 1305

Arnoldi, C (1957) Personal correspondence

Barcroft, J, and Rothschild, P (1932) " The Volume of Blood in the Uterus during Pregnancy " *J Physiol*, 76, 447

— Herkel, W, and Hill, S (1933) " The Rate of Blood Flow and Caseous Metabolism of the Uterus during Pregnancy " *J Physiol*, 77, 194

Bean, W B (1945) " The Cutaneous Arterial Spider " *Medicine*, 24, 243

Bernard, Claude (1858) " Sur une Expérience Relative a l'influence que les Nerfs Exercent aux Phenomênes de Circulation " *C R Soc Biol*, *Paris*, 5, 29

Berntsen, A (1927) " Des Varices du Membre Inferieur " *Acta chir scand*, 62, 61

Birger, I (1941) " Ulcers Crurise-atiologi-tarapi " *Nord méd*, 10, 1240

Burrows, H, and Kennaway, N M (1934) " On some Effects Produced by Applying Oestrin to the Skin of Mice " *Amer J Cancer*, 20, 48

Clauberg, C (1938) " Künstlich erzeugtes Tubemuachstum ein mit belingender Faktor bei der Behelung von sterilitat durch Follikelharmon " *Zbl Gynäk*, 62, 1034

Curwen, I H M, and Scott, B O (1952) " The Ambulant Treatment of Complications Resulting from Varicose Veins and Allied Conditions " *Ann Phys Med Lond*, 1, 17

Delater, G (1927) " Pathogeny of Varicose Veins " *Irish J med Sci*, 6, 199

Duguid, J B (1951) " The Aetiology and Pathogenesis of Varicose Veins " *Practitioner*, 166, 223

Eger, S A., and Caspar, S L (1943) " Etiology of Varicose Veins from an Anatomic Aspect " *J Amer med Ass*, 123, 148

Fischer, B (1904) " Die Pathogenese der Phlebektasie " *Arch Derm Syph*, *Wien*, 70, 195

Foote, R R (1946) " Varicose Veins " (Letter) *Brit med J*, 2, 680

— (1947) " Varicose Veins " *Lancet*, 1, 83

— (1950) " Heredity and Leg Ulcers " (Letter) *Brit med J*, 2, 1495

— (1958) *Physical Treatment of Varicose Ulcers* Edinburgh, Livingstone

Gaugier, L (1926) " L'Étiologie des Varices " *Pr med*, 2, 1442

Glass, S J, Edmondson, H A, and Soll, S N (1940) " Sex Hormone Changes Associated with Liver Disease " *Endocrinology*, 27, 749

Hasebrok, K (1916) " Eine physchalisch-experimentell begründete neue Aufferung der Pathogenese der varicen " *Dtsch Z Chir*, 136, 381

— (1916 " Ueber die Bedentung dar arterien pulsationen für die Stromung in den Venen und die Pathogenese der Varicen " *Pflüg Arch ges Physiol*, 163, 191

Hundley, J M, Jr, Diehl, W K, and Diggs, E S (1942) " Hormonal Influences upon the Ureter." *Amer J Obstet Gynec*, 44, 858

Jurgensen E (1920) " Mikrokapillarbeobachtungen " *Dtsch Arch klin Med*, 132, 204

Keen W W (1909) *Surgery*, 4, 1149 Philadelphia, Saunders

King E S J (1950) ' The Genesis of Varicose Veins ' *Aust N Z J Surg*, 20, 126

King, T W (1837) ' The Safety-Valve Function of the Right Ventricle of the Human Heart " *Guy's Hosp Rep* 2, 104

Kramer C. (1898) Ueber die Aetiologie und die chirurgische Therapie (Insbesondere die Radicaloperation) der Varicen au der unteren Extremitäten." *Münch med Wschr.*, 45 1206-

Lacassagne, A. (1933) "Metaplasie Epidermoide Provoquée par les Injections de Folliculine *C R. Soc Biol., Paris* 113 590

Lancet (1950) "Varicose Veins and Military Service" *Lancet* 2, 7

Larson, R. A., and Smith, F L. (1943) "Varicose Veins." *Proc Mayo Clin.*, 18 400

Lealis Leal (1707) *Exercitato epistalica.*

Ledderhose, G (1906) "Studien über den Blutlauf in der Hautvenen unter Physiologischen und Pathologischen Bedingungen." *Mitt Grenzgeb Med Chir* 15 355

— (1908) *Ibid.*, 18, quoted by Rost F (1920) "Pathologische Physiologie des Chirurgiens (Experimentelle Chirurgie)" Leipzig F C. W Vogel

Lower R. (1669) *Tractatus de Corde item de Motu et Colore Sanguinis et Chyli in eum Transitu* p 133 London James Allestry

McAusland A. M. (1943) "Pregnancy in Association with Severe Varicose Veins" *West J Surg* 51 199

McPheeters, H O (1949) "The Value of Oestrogen Therapy in the Treatment of Varicose Veins Complicating Pregnancy" *Lancet* 69 2.

— and Anderson, J K. (1939) *The Injection Treatment of Varicose Veins* 2nd ed. Philadelphia Davis.

Magnus, G (1921) Zirkulationsverhältnisse in Varicen" *Dtsch Z Chir* 162, 71

Meisen, V (1937) *Varicose Veins and Hemorrhoids* p 140 Springfield, Ill Thomas

Ministry of Health (1946) "On the State of the Public Health during Six Years of War" *Rep med. Offr Minist Hlth, London*

Moore, H D (1951) "Deep Venous Valves in the Aetiology of Varicose Veins." *Lancet* 2, 7

Nicholson, B B (1923) "Histopathology and Aetiology of Varicose Veins." *Arch Surg., Lond* 7 47

Quincke, H (1868) "Beobachtungen über Capillar und Venenpuls." *Berl klin Wschr* 5 357

Sicard J A and Gaugier L. (1931) *Le Traitement des Varices par les Injections Locales Sclerosantes* 3rd ed Paris Masson

Slater P (1946) *Survey of Sickness October 1943 to December 1945* A Report of a Series of Surveys on the State of Health of the Civilian Population between these dates made for the Ministry of Health. London H M.S O

de Takáts, G., and Quint, H (1930) "The Injection Treatment of Varicose Veins." *Surg Gynec Obstet* 50 545

Turnbull J A. (1945) "Allergy as a Factor in Surface Ulcers and Varicose Veins, Phlebitis and Thrombosis." *Amer J digest Dis* 12, 272.

Veal, J R., and Hussey H H (1941) "The Venous Circulation in the Lower Extremities during Pregnancy" *Surg Gynec Obstet.*, 72, 841

Wagner F B and Herbut, P A (1949) "Etiology of Primary Varicose Veins." *Amer J Surg* 78 876

Wolf G (1941) *Praxis* 36 41

CHAPTER 2

HISTORICAL LANDMARKS IN TREATMENT

" The Future is only the Past again entered through another gate "
Sir Arthur Pinero—*The Second Mrs Tanqueray*, Act IV

BEFORE studying our present-day conception in the treatment of varicose veins, much may be learned from a study of past methods The recognition of varicose veins and their treatment is as old as is medical literature Many " gates " have been opened by pioneers in the past, only to be closed again when a failure to destroy the persistent varix has once again made itself evident The struggle against the varix still goes on unabated and many more " gates " will need to be opened before complete success is obtained At present, as in the past, the attack on varicose veins has been directed more towards the mechanical effect of the varicosity rather than to the basic causes which make the normal vein go on its wayward and tortuous course It is only in recent times that a little light has filtered through regarding further factors in the aetiology of the condition, and it is to be hoped that one day the surgeon's knife may no longer be so essential

Modern treatment is comparatively safe and relatively kind to the sufferer, who in the past was frequently subjected both to risk and to pain However, it will be seen that the struggles of the early pioneers, working in the dark with neither asepsis nor anaesthesia, were valiant and call for much admiration Knowledge of both the pathology and physiology of varices was slight until the seventeenth century, when Harvey published his famous *De Motu Cordis* (1628) After that date therapy developed along more rational lines

Nearly 2,500 years ago Hippocrates, the legendary Father of Medicine, was on the whole against the incision of a superficial varix in those cases in which a congested black limb appeared to need such treatment He made the observation that such treatment caused large ulcers to appear He directed that the varix itself should be punctured in as many places as was possible This trauma at multiple points may have damaged the intima sufficiently to cause a thrombosis Again, sepsis may have played a part in the production of this clotting Most of the Hippocratic writings are attributed by present-day classical philologists to the Hippocratic school rather than to Hippocrates himself, whose dates are usually given as 460–375 B C The famous bust of Hippocrates in the British Museum is stated to be that of the stoic philosopher Chrysippus However, be that as it may, varices were recognized and studied by the physicians of that time Faith healing for varicose veins was practised at this period, and Fig 4 shows a relief of varicose veins dating back to the fourth century B C. This was taken from a temple near Athens and is now preserved in the National Museum of Athens The relief represents a clay model of a varicose limb being laid on the altar of the temple, and the picture is well reproduced in Maxime Laignel-Lavastine's superbly illustrated *Histoire Générale de la Médecine* Those tempted to smile at this method of treatment must remember that nature cures, faith healing and wonder

drugs for the cure of varices still tempt the patient from modern rational treatment which might lead to alleviation or to cure

The first mention of surgery applied to varices was that performed by an unknown operator somewhere between 155–86 B C. In Plutarch s *Lives* it is stated that

Marius Roman consul and general is praised for both temperance and endurance of which latter he gave a decided instance in an operation of surgery For having, as it seems, both his legs full of great tumours, and disliking the deformity he determined to put himself into the hands of an operator when without being tied, he put out one of his legs, and silently without changing countenance, endured most excessive torments in the cutting, never flinching or complaining but when the surgeon went to the other he declined to have it done saying, I see the cure is not worth the pain "



FIG 3 —Hippocrates.



FIG 4 —Varicose veins 2,400 years ago

It is of interest that in those days both legs were dealt with at the same operation Surgeons are at variance in modern times as to the advisability of this procedure, since no additional risk, however small, should be taken when dealing with the non-lethal condition of varices. It is advisable in most cases to operate upon each leg separately

Celsus (53 B.C.–A.D 7)

Aurelius Cornelius Celsus a Roman, said to have been a medical historian rather than a physician, imprinted his name on the pages of medical history in the most elegant Latin He lived in the days of Tiberius Caesar His method of

mostly in those who overwork their feet, and stand long on them, and through prolonged work of the body In this way the mixture sinks into the veins that are in the legs, and therefore this happens mostly in peasants, porters and sailors, and the symptom of this disease is that these veins become tortuous and thick and incline to be green or black in color, even if only slightly so "

The Arabic name for varicose veins, *dawali*, a vine, is in itself beautifully descriptive He described varicose ulcers, noting that such ulcers were usually circular and healed very slowly In all his descriptions of varicose ulceration he does not refer to them occurring in women This is possibly due to the fact that, at that time, Mohammedan women were said to have no souls, for this reason their bodies were prized accordingly Some may feel that little has occurred during the centuries to disprove Haly the Sublime's opinion Haly had no knowledge of the circulation, but he had a good clinical knowledge He was a humoralist—in other words, one who ascribed almost all diseases to a faulty mixture of the humours of the body

Albucasis (1013–1106)

Albucasis of Cordova was a famous Arabian surgeon who based his writings on those of Paulus Aegineta He was a conservative surgeon and did much to raise the status of surgery which " had passed into the hands of vulgar and uncultivated minds and had fallen into contempt " He described clearly the technique of multiple ligation and vein stripping, advocated by Mayo (1906), and begins and ends his book with the motto " Caution ". Possibly in no field of surgery is this warning more apt

Apart from obscure writings of the monks during the next 400 years, there is but little medical literature to guide us during this dark age It is of interest to note that the Church was against the shedding of blood and that this influenced the lack of medical progress, since medical treatment was chiefly in the hands of the religious orders and the charitably inclined lady of the castle

Gui de Chauliac (1300–1368)

In the middle of the fourteenth century this French surgeon was a most prominent authority on surgery He was physician to three Popes and his great book on surgery, *La Grande Chirurgie*, influenced teaching of the art for centuries He wrote extensively on the subject of varices, quoting both Albucasis and Haly Abbas He favoured the application of astringents to the veins and careful dieting in combination with blood-letting From the surgical angle he favoured the cautery and the opening of the vein at different sites He insisted that clots should be evacuated from the veins and was not averse to the evulsion of the varices

However, he warned the reader to exclude scorbutic or syphilitic infections when giving this treatment One cannot help being impressed by his powers of observation regarding the pathogenesis of varices nearly 600 years ago It is an interesting fact that Gui de Chauliac insisted that obesity affected the future of varicose limbs In present days we realize the importance of the association between excessive weight and varicose ulceration

Ambroise Paré (1510–1590)

Ambroise Paré was a French army surgeon who was however equally at home in an army camp or at Court. Worshipped by soldiers the battlefield was his university and he revolutionized and modernized the treatment of gunshot wounds He was known as the surgeon of princes and prince of surgeons His mid thigh ligation of varices was similar to that which was carried out by



Fig 8 —Gui de Chauliac.



Fig 9 —Ambroise Paré

Paulus Aegineta in the seventh century He also advocated the use of escharotics to the skin overlying a varix in order to produce thrombosis Paré has been criticized for his lack of knowledge regarding the circulation of the blood, but it is to be noted that he was working in a period antedating Harvey s revolutionary thesis. Describing varices he says

> "The matter of them is usually melancholy blood, for Varices often grow in men of a melancholy temper and which usually feed on gross meats, or such as breed gross and melancholy humors. Also women with child are commonly troubled with them by reason of the heaping together of their suppressed menstrual evacuation It is best not to meddle with such as are inveterate "

Johann Scultetus (1595–1645)

Johann Scultetus, an ingenious German inventor of surgical instruments of the seventeenth century gives us many interesting illustrations of vein surgery Fig. 10 shows varicose veins of the lower leg being excised.

Richard Wiseman (1621–1676)

This surgeon employed compression treatment for the healing of varicose ulceration three hundred years ago His picture hangs in the Royal College of Surgeons and his book on surgery the style of which was praised by Dr Johnson was one of the earliest to show a firm scientific bias He was a convinced Royalist

and was imprisoned for his cause Prior to his appointment as Sergeant Chirurgeon to King Charles II he fought in the Dutch Naval Service and was also a surgeon in the Spanish navy

224 EXPLICATION DE LA XLVI. TABLE

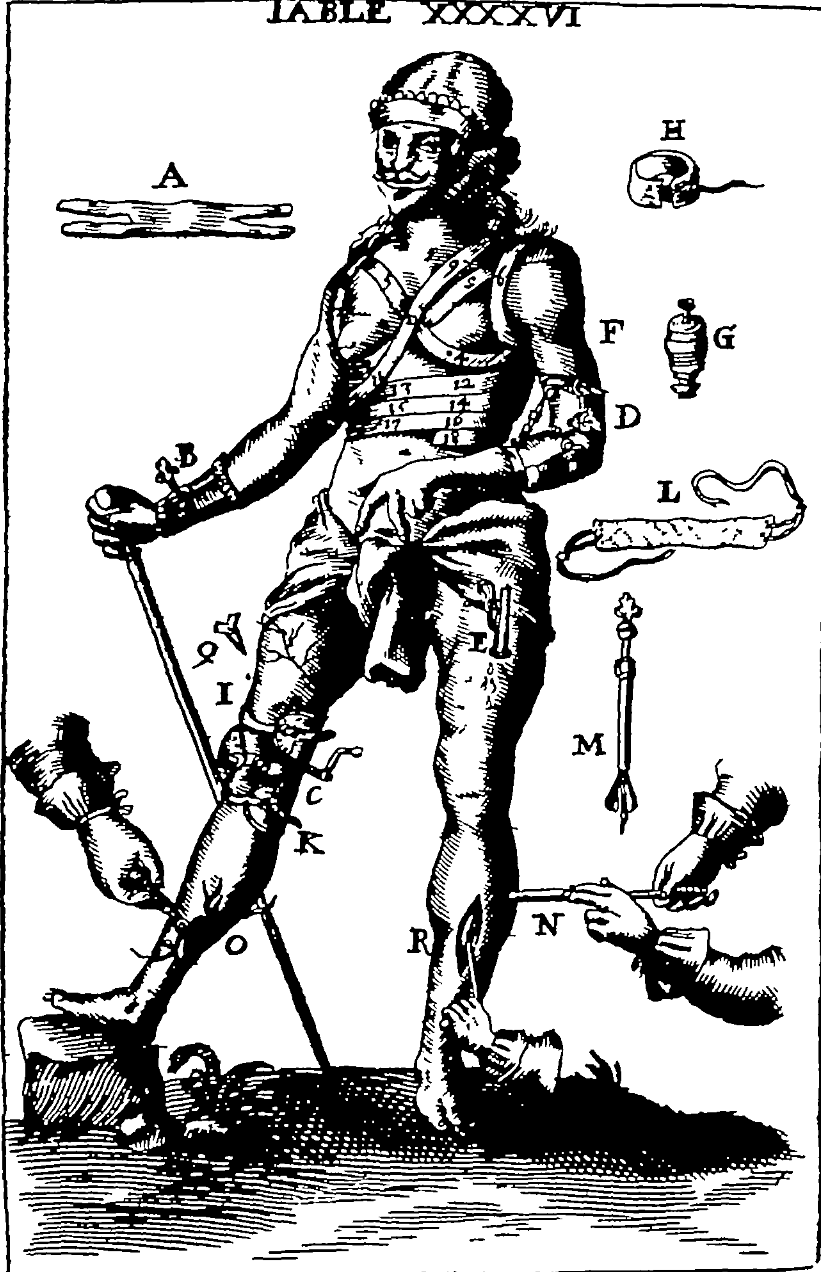


FIG 10—Surgical mannequin showing sites and instruments for various operations The local excision of varices is demonstrated clearly

Pierre Dionis (circa 1668–1718)

This famous surgeon was Surgeon-in-Ordinary to the Queen of France and to the Empress Maria Theresa He was an author of renown whose standard works were even translated into the Chinese language This many-sided and

brilliant writer packed his books with anecdote and gossip such as the story of Frère Jacque, the Wandering Lithotomist, who won fame for his skill in that branch of surgery



Fig 11 —Richard Wiseman



Fig 12.—Pierre Dionis.

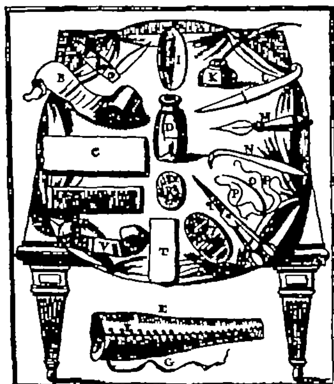


Fig 13 —Instruments used for varicose vein operations in the 18th century by Pierre Dionis note the leather stocking and the flat stones used for the local compression treatment of ulceration.

Dionis was particularly interested in the varix but as far as the aetiology was concerned was satisfied that it was due to two causes—that the blood had become gross and that strain caused the vein to form a small purse to allow the blood both space and liberty The fact that he realized that strain was a factor in the causation of varices is particularly interesting, since we now know

how frequently the sapheno-femoral valve may become damaged in those who are accustomed to lifting weights This is particularly noticeable in the case of athletes His reference to venous valves that they " form steps which serve to help the ascension of the blood and so facilitate its return to its source " is beautifully descriptive As far as cure was concerned, he favoured the application of various astringents, including sanguis draconis and terra sigillata He also strongly recommended the compression treatment of the legs by means of bandages and the fashioning of stocking support, either from coarse linen or from dog skin, worn from the ankle to the knee The surgical attack consisted mainly of " making orifices longways to the vein " He refers to the use of the cautery which he quotes as being also useful in veterinary surgery However, having practised many methods of attack, he became conservative in his views and at one stage says " of these methods the best is the strait stocking "



Fig 14 —Jean Louis Petit



Fig 15 —Lorenz Heister

Jean Louis Petit (1674–1750)

Jean Louis Petit, who was the first director of the Academie de Chirurgie of Paris, wrote very clearly regarding the aetiology of the varix He also wrote extensively regarding the radical excision of varices, which operation he practised He stated that anything which obstructed the rising of the blood in the veins was the principal cause of varicosities He also noted that pregnancies were important in the causation of this trouble Prolonged standing and tight garters were both mentioned, rest in bed for varicose ulcers was advised in his writings

Lorenz Heister (1683–1758)

Lorenz Heister was a German surgeon who failed to grasp the true physiology and pathology of varicose veins, and, despite the years between, his blood-letting procedure was no improvement over those of Pare and Paulus Aegineta He taught that large varices should be laid open by longitudinal incisions followed by the use of compression bandages after letting half a pint of blood escape Heister recommended percutaneous vein thread ligature through the skin, under and

around the varix, prior to varicose phlebotomy In 1750 we find him reapplying the percutaneous suture, in multiple fashion over a length of rubber tubing this operation being similar to the Schede operation described in 1877 Again Davat (1833) was advocating the operation originally practised by Heister a hundred years previously

Sir Everard Home (1756–1832)

At the end of the eighteenth century, Sir Everard Home, brother in law of John Hunter was working on the treatment of ulcers of the legs In 1811 he described the salutary effects of including the saphena magna in a ligature above the knee



FIG 16 —Sir Everard Home

in cases of chronic varicose ulcers associated with status varicosum Ulcers of the legs were considered as a branch of military surgery and he comments No surgical complaint incident to the soldier has deprived His Majesty s Service of so many men as that of ulcers of the legs

History repeats itself since the highest surgical admission rate to the Emergency Medical Service hospitals during World War II was for varicose veins His observations on the presence of collateral branches are of interest and in one of his case reports he brings out this point most clearly

> " The case of Sarah Stapleton, operated on in 1794 In the time of operation, a smaller vein was opened running parallel to the vena saphena, which afforded a reason able suspicion that the disease might recur Fifteen months after the vena saphena had been tied, a vein in the place where the ulcer had formerly been situated burst, and bled freely Upon examining the vena saphena at the part where the ligature had been applied two very large veins were discovered so that there must have been at the time of the operation, two small branches, one on each side of the vena saphena one of these only had been observed at the former examination These two veins were now included in one ligature

Thomas Baynton (1761–1820)

No comments on varicose ulceration can be considered to be complete without a reference to Thomas Baynton who was one of the pioneers of the compression treatment of varicose veins His book *A New Method of Treating Old Ulcers of*

the Legs was written 150 years ago, but his methods varied but little from those of the present day He steeped calico bandages in warm diachylon and resin and treated the ulcers by compression whilst the patient was ambulatory. His fame spread from the good results he obtained and allowed him to leave £23,000

We have no portrait of this most remarkable and eccentric character, but the sayings of his contemporaries help us to evolve a most interesting mental picture In his youthful days a fellow apprentice said of him " he was a tyrant that there was no enduring him " Later, one of his own apprentices, James Dew, complained of his stinginess, saying " that the pump handle was troubled more than was the beer cock " Contemporary historians said he was a violently active and handsome man with a florid face He " bowed a little too much ", always " acting the agreeable ", and when operating " talked all the time to both patient and assistants " He left a will extending to the length of 132 folios and on his death bed, Richard Smith, the surgeon, said " the room was quite full of us " His work has lived after him and we should indeed be grateful to such as he

Rima (1777–1843)

Rima, an Italian surgeon, was credited with being the pioneer who first ligated the saphenous vein in the thigh for varices, an operation generally credited to Trendelenburg much later But historical research has proved that Celsus, centuries earlier, had described this operation, and Paulus Aegineta had actually performed it

Sir Benjamin Collins Brodie (1783–1862)

This famous surgeon was a pioneer in subcutaneous surgery of the limbs As early as 1814 he was publishing his views on the treatment of varicose veins He was not only a very versatile surgeon but also a great writer, philosopher and administrator He was the first to observe and demonstrate the reverse flow of blood in a varicose saphenous vein In 1846 he described the test which was destined to receive the name of Trendelenburg half a century later Trendelenburg's description of the test was almost a verbatim translation of Brodie's observations Some of these observations are well worth the reader's consideration in present days

Standing by the bed-side of a sufferer from varicose ulceration, he says " Here is a case of a very distressing nature, and such a case as may meet you at every turn of your practice, and your reputation in early life will depend more upon understanding a case of this kind, than upon your knowledge of one of more rare occurrence " In discussing the compression treatment of gravitational ulcers, he states " In some cases of varicose veins, the skin is irritated by the resin which the common adhesive plaster contains, and you may then substitute for it the red plaster [the emplastrum thuris or emplastrum roborans of the old dispensatories] " These observations show that he was fully cognizant of skin allergy to plaster, and 100 years later we have little more information than he had at that time " In some persons you will find a flannel roller more convenient, at any rate, the patient can apply it better for himself " This statement demonstrates that he was conversant with the advantages of the non-adhesive type of bandage over the unpleasantness of the sticky bandage His observations on the correct application of a bandage could not be bettered by any modern writer

"I must here make a few observations respecting the use of the roller It should be applied from the foot upwards It need not be worn at night, when the patient is in the recumbent posture, but it should always be replaced as soon as he rises in the morning. Care should be taken that the heel is supported, as well as the rest of the foot and that a moderate, but equal, pressure be made on the whole limb Especially the pressure above ought not to be greater than that below for in that case the veins below must necessarily become distended. A tight garter increases varicose veins

Here once again history is repeating itself since as early as 1676 Richard Wiseman, Sergeant Chirurgeon to King Charles II recommends that the oedematous leg should be Rowled up with a compress and Bandage from foot to



FIG 17 —Sir Benjamin Collins Brodie.

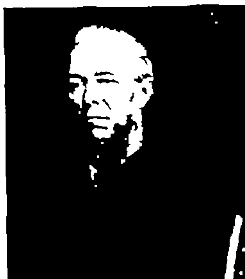


FIG 18 —John Gay

gartering Subsequent treatment should be given by a laced stocking Again in 1783 Michael Underwood, in a *Treatise on Ulcers of the Leg* pleads for the treatment of varicose ulceration by firm bandaging without rest.

Brodie s further remarks on the treatment of ulceration are still unobserved by many practitioners as witness the following statement

> "I find a young dresser frequently interposing a piece of lint, with or without simple ointment, between the plaster and the sore It is a very injurious practice it keeps the sore slopped with its own discharge and it prevents the plaster from making that uniform and regular pressure which is required. When the sore is healed, the patient should continue to wear the plaster for some time afterwards, otherwise the cicatrix will give way and for the same reason he should ever afterwards wear the bandage."

How many cases do we see in modern times in which a healed ulcer is given no further support, with the almost inevitable recurrence in the course of time?

His views on the surgical treatment of varices were clouded by the non antiseptic era with its attendant mortality For this reason he did not think it advisable to submit patients suffering from this condition to surgery He dismisses the operation of subcutaneous division of the vein by stating I always observed that if I cured one cluster two smaller ones appeared, one on each side and that, ultimately I left the patient no better than I found him

These and many other observations made well over 100 years ago are nearly all accepted in modern times, and, combing through the literature of those early days, one finds that this great philosopher and surgeon must have spent many years of patient observation on this baffling subject History recounts that he seldom took a holiday and that his enormous practice brought in more than £10,000 a year It is all the more astonishing to find that he has added so much to the solution of the varicose vein problem

John Gay (1812–1885)

Gay was much in advance of his time regarding the pathology of varicose ulceration He appreciated the fact that ulceration was often present without the presence of varices He also appreciated the converse—in other words, severe varicosities could be present without ulceration It took many years for his original observation that ulceration was not as a rule a direct consequence of simple varicosity to be appreciated



FIG 19 —Richard J Levis



FIG 20 —Friedrich Trendelenburg

Richard J. Levis (1827–1890)

In the United States of America, Richard J Levis was performing subcutaneous ligations of varices by means of metallic wire In Gross s *System of Surgery* we learn that up to 1864 he had performed thirty-eight operations without mortality or unfavourable results In passing it is of interest to note that this famous American surgeon was Surgeon-in-Chief to the two United States Military Hospitals in Philadelphia and was one of the original members of the American Surgical Association

Friedrich Trendelenburg (1844–1924)

This highly cultured surgeon of international reputation has already been mentioned as having published an account of the Trendelenburg test 50 years after

it had been described carefully by Sir Benjamin Brodie His work in the surgical field of varices, however was invaluable He described the ligation of the internal saphenous vein in the middle of the thigh and his published results some 4 years after he had started to perform this operation admitted a recurrence rate of 22 per cent. This high recurrence rate led to the operation falling into disrepute

Paul Gerson Unna (1850–1929)

One of the greatest figures in the history of dermatology His gift to the treat ment of varicose ulceration in the shape of Unna s paste is invaluable When mixed into a bandage it offers a pliable support which is used throughout the world



Fig 21 —Paul Gerson Unna.



Fig 22.—William Moore.

He was said to start work every day at 7 a m to go to bed at 11 p m as a routine and to arise in the middle of the night in order to do a further few hours work He was also said to have never read the newspapers The world is indeed indebted to him.

William Moore (1859–1927)

This surgeon performed a high resection of the internal saphenous vein in his out patient department The patient was ambulatory He wrote Site of ligature As the operation aims at preventing any reflux of blood into the vena saphena and its branches this object is surely much better attained by ligaturing above the junction of any of the branches belonging to the lower extremity if the ligature is applied low in the thigh, this object is not attained with the same cer tainty Since his instructions were that the site of incision should be 2 inches below Poupart s ligament, it is doubtful whether the site of ligation of the internal saphenous vein was flush with the femoral vein

g Perthès (1869–1927)

-.rthès was the originator of the test which bears his name He was well in advance of his time in the investigation of the patency of the deep veins of the leg He studied at Bonn under Trendelenburg and was one of the originators in the X-ray treatment of cancer

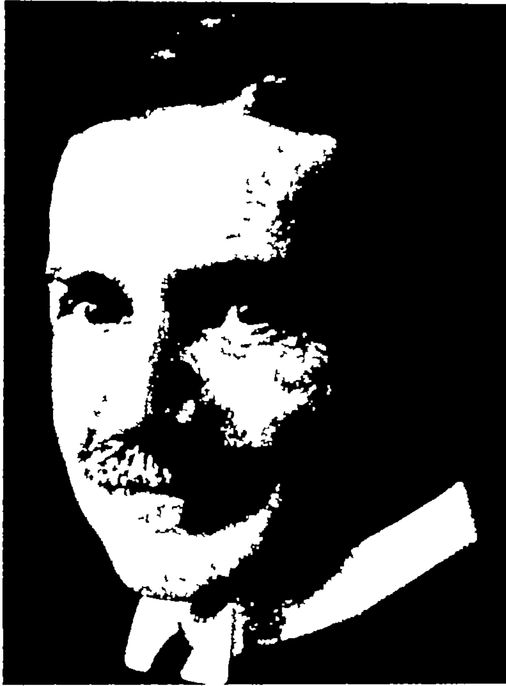
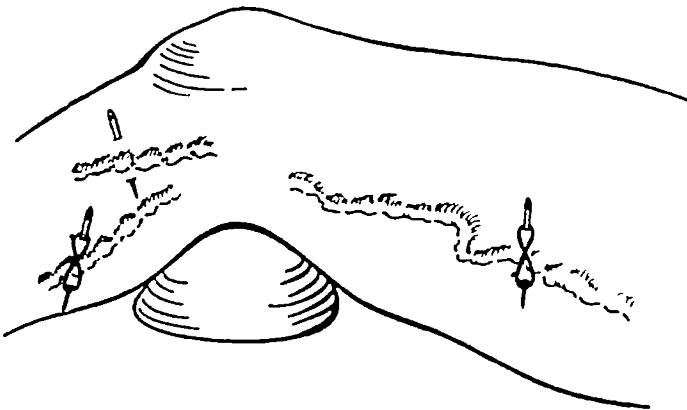


FIG 23 —Georg Perthès

MORE RECENT OPERATIVE METHODS

Early operative procedures

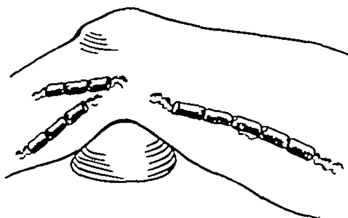
It is only during the past 70 years that surgery has been used to any extent in the treatment of varicosities Antisepsis and later on asepsis made the surgeon's



1837 DAVAT'S METHOD
FIG 24 —Percutaneous ligation of varices

task less hazardous, since risks of infection were lessened Most of the surgical work on varices in the eighteen-seventies emanated from the German schools, and

for the sake of brevity it is proposed to present these varied operations diagrammatically (Figs. 24 25 30 and 31) Only a few of the more ingenious procedures will be mentioned.



1877 Schede's operation

Fig 25.—Multiple ligation and section of varices. Percutaneous catgut ligatures tied over rubber tubing. As many as 30 ligations were used for a single case Recurrences were extensive

The Trendelenburg operation (1895)

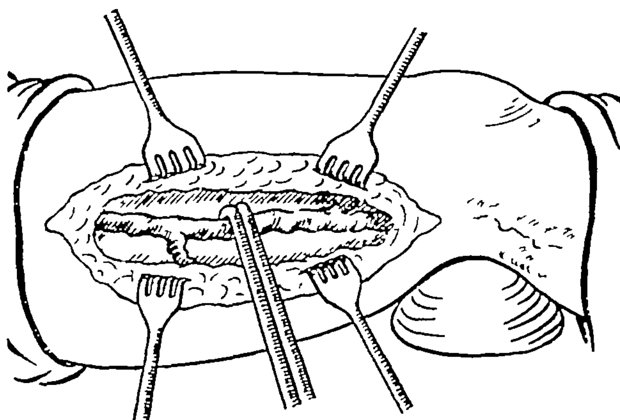
Perthès published a series of case results following operation by the Trendelenburg method of ligating and sectioning the internal saphenous vein in the



Fig 26.—Otto Wilhelm Madelung (1846–1926)

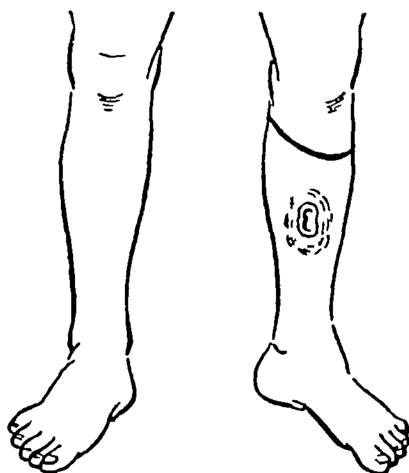
mid thigh area. The method failed owing to the high recurrence rate. The fact that these ligations were being performed too low in the thigh was appreciated by Perthès, who stated

" It seems that in cases in which the saphenous is not present as a solitary trunk, or shows many ramifications, it were best to perform the operation high above The higher the main trunk is ligated, the fewer will be the number of branches above the



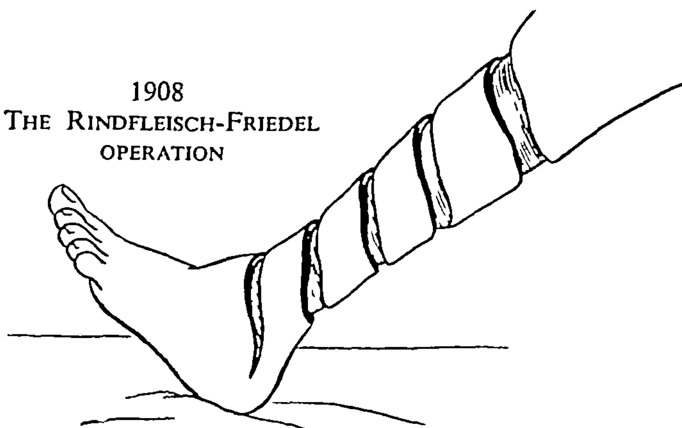
1884 MADELUNG'S OPERATION

FIG 27 —A radical procedure consisting in the complete extirpation of the internal saphenous vein and its main tributaries, through lengthy incisions in the thigh and lower leg Discarded owing to the high mortality from pulmonary embolism



1893 PETERSON'S OPERATION (KNOWN AS THE SCHEDE OPERATION)

FIG 28 —A circular incision was made through the skin and subcutaneous tissue The object was to interrupt the superficial circulation at that level



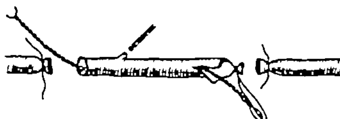
1908 THE RINDFLEISCH-FRIEDEL OPERATION

FIG 29 —This operation is described by Ochsner as " one of the most atrocious crimes a heavy-handed surgeon ever inflicted on his patients " His description of the operation is as follows "The operation, which fortunately was reserved for severe cases of varicosities, consisted of excision of the internal saphenous vein in the thigh and a spiral incision through the skin and subcutaneous tissue down to the deep fascia, beginning at the knee, encircling the leg four to seven times and ending at the foot The bleeding superficial veins were ligated and the wound packed open, making a deep gutter necessitating healing by second intention "

ligation site, and the less likely will be the chance for the varices again to come under the influence of the blood's pressure In cases of large varices spread over the entire limb, one can show that a compression right at the entrance of the saphena magna in the femoral has a definite effect on the Trendelenburg test, while at all other sites there is either no effect or it disappears quickly This is therefore preferred as the site of election for operation in these cases '

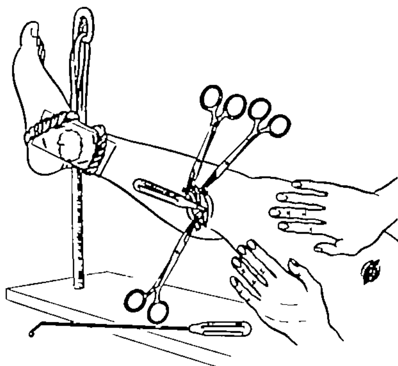
W Wayne Babcock (Contemporary—Born 1872)

This famous surgeon from Philadelphia wrote a paper in 1907 many years in advance of its time, and all readers are recommended to study this lucid exposition of vein stripping It was Babcock who first gave us the idea of making the



1905 KELLER'S OPERATION

FIG 30 —The removal of varicose veins by passing a wire along the lumen. The withdrawal of the wire inverted the vein which was pulled out through its own lumen The reports of his cases were satisfactory



1906 MAYO'S OPERATION

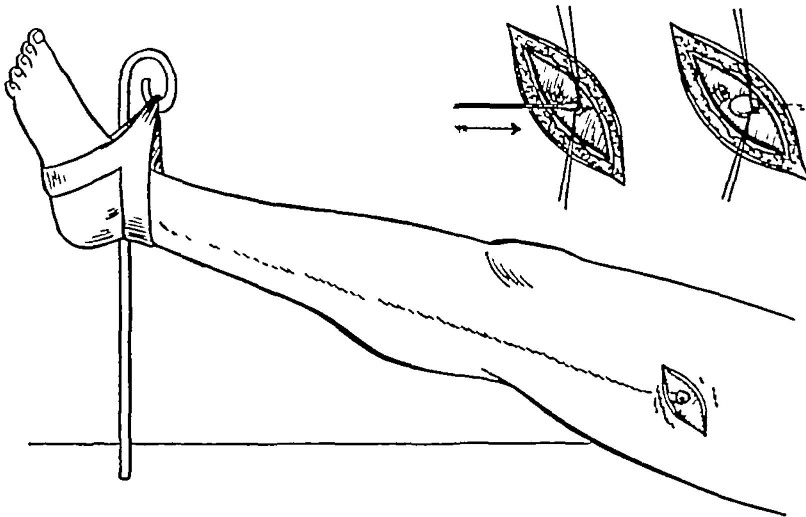
FIG 31 —The "vein stripper" a small ring on a long handle is threaded over the proximal end of the divided vein, which is held taut whilst the ring is pushed along the vein to a lower level where a further incision allows removal of the segment. This procedure is still used by many surgeons who are not deterred by the laceration of the communicating veins occasioned by the stripper Ochsner quotes Berntsen's (1927) statistics reporting on the results of vein extirpation in 376 cases. The embolism rate was 7 2 per cent and the death rate was 0·7 per cent Again, Anschutz and Löhr (1929) stated that fatal results occurred in from 0 5 to 1 per cent of cases This extra luminar method of stripping varices is practised by many at the present time and there is no doubt that the risks of this operation are very much less. This is in the main due to the fact that there is a better understanding regarding the causation of deep vein thrombosis and to the valuable help which the patient may now receive from antibiotics at the time of the operation.

extracted vein pleat against the head of the stripper and this is the basis of our modern method of stripping The instrument he used had a small head, however, and therefore presented many of the difficulties experienced with the Keller technique In other words, inversion of the vein was apt to occur with resulting



FIG 32 —W Wayne Babcock

rupture of the vein with the formation of haematomas As will be seen later the use of a large head to the stripper obviates these faults In a personal communication Dr Wayne Babcock states that he still has his original stripper for the



1907 BABCOCK'S OPERATION

FIG 33 —This modification of Keller's operation (*see* Fig 30) consisted in the insertion of an acorn-tipped guide instead of the twisted wire of Keller

removal of sections of varicose vein and he uses sclerosants in order to thrombose any branches which have evaded avulsion Anyone studying the history of varices must give pride of place to the two famous American surgeons, Homans and Babcock, who have done so much in the advancement of our present-day methods

John Homans (1877–1954)

Homans s flush ligation of the internal saphenous vein (1916)

This surgeon s recommendation that the internal saphenous vein should be tied flush at its junction with the femoral vein above any of its collaterals is the basis of the modern operation His views had already been expressed by Moore in 1896 and by Tavel in 1904 but, as stated previously much honour is due to Homans in his appreciation of the great importance of meticulous technique at



Fig 34 —John Homans.



Fig 35 —A. Dickson Wright

the site of the sapheno-femoral junction Furthermore, his studies showed that the " varicose ulcer was usually due to deep vein thrombosis Since the time of Gay (1812–1885) little had been said about the important pathological finding I had the privilege of meeting Homans at his home in Boston My impression was of a very modest and cultured gentleman When he signed the first edition of this manual he said You have come a long way to visit someone who knows but little

A. Dickson Wright (Contemporary)

No book on varicose disease would be complete without reference to the work of Dickson Wright. In the 1930 s he impressed the importance of the gravitational factor in varicose ulceration His original views on compression treatment and especially on the use of the elastic adhesive bandage were invaluable just as his insistence upon early ambulation was all important in the treatment of superficial phlebitis In addition he emphasized Homans s advice on the carefully performed high resection operation In my view however his most important work in this field was to make it obvious that the study of varicose disease was indeed a specialized subject His efforts helped to rescue the sufferer from varices from being the last on the list " in the operating theatre In addition to his contributions

to surgery, generations to come will remember him not only as being one of the most brilliant speakers of our time, but also as one possessing a sense of humour second to none

De Takàts's ambulatory procedure (1930)

De Takàts's recommendation that the operation should be done as an ambulatory procedure was an important advance It will be noted, however, that again Moore of Melbourne had practised this procedure on his out-patients some 34 years previously

INJECTION TREATMENT

The history of the injection treatment of varicose veins dates back to 1853 It is of particular interest to examine the various operations which have been performed over the past hundred years and to see how the injection treatment and operative technique became wedded and so produced a technique which has been practised extensively during the past quarter of a century This operative-injection treatment combination was considered by the majority of surgeons to be the ideal until recent times, when, as will be explained later, the use of sclerosants at the time of the operation was gradually given up

The invention of the hypodermic syringe

Injection treatment was made possible by the introduction of the hypodermic syringe over one hundred years ago This invention has been attributed in many books to Pravaz and to Francis Rynd Recently, however, it has been pointed

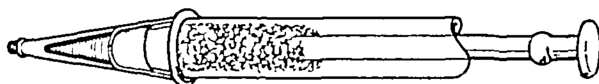


FIG 36—Fergusson's syringe (1855)

out by Howard Jones that there was no true "invention" of the hypodermic syringe The subcutaneous route was adopted by Wood of Edinburgh, and for this purpose he adapted the syringe made by Fergusson in 1855 (Fig 36) There is little doubt that research now shows that Great Britain can claim more credit for the hypodermic syringe than was previously admitted Howard Jones's analysis of the various claims regarding the origin of the hypodermic syringe is both painstaking and fascinating All those interested in this most interesting research into history will be well advised to study his paper Operative and sclerosant methods of treatment were used in combination over 40 years ago when Schiassi of Bologna performed the first simultaneous ligation and retrograde injection of the vein (Fig 39) This marriage of the two treatments proved to be the most successful attack against the varix for a long period It is now generally recognized, however, that a careful high resection of the internal saphenous vein in combination with a bloodless intra-luminar stripping offers our patients the best prognosis, as far as recurrence of their troubles is concerned

During the 50 years subsequent to the introduction of the hypodermic syringe there is but little evidence that more than a few patients received sclerosant treatment Toxic substances were used and the reported results were most unsatisfactory, since infection and suppuration were all too common

Substances used for injection

Early sclerosants

Ferric chloride, iodotannin pure phenol mercury bichloride, alcohol Lugol s solution and many others were all tried and found wanting, although successful case reports were published as also were severe complications

For reference purposes some advocates of these solutions were as follows

Ferric chloride	1853 Cassaignac and Debout
	1856 Soule
	1860 Corbin
	1864 Miller
	1876 Weinlechner
Iodotannin	1855 Desgranges
	1868 Panas
	1880 Burroughs and Delore
Phenol	1885 Weber
	1886 Stevenson

In the eighteen-seventies many Continental clinics, especially that of Vienna practised perivenous injection This treatment was applied to varicose veins piles and varicocele, and has persisted to the present day so far as haemorrhoids



FIG 37 —Alexander Wood (Secundus), M D (1817–1884) Pioneer of the subcutaneous route.



FIG 38.—Charles-Gabriel Pravaz.

are concerned, depending on the production of scar tissue resulting from the inflammatory process occasioned by the irritant injected This method of peri venous injection was given up entirely for varices

It is of interest to note that in 1894 the Surgical Congress at Lyons condemned the sclerosant treatment of varices, and it was not until 1911 that the safe era of injection treatment could be said to have become established. In part this era resulted from the good work done by Ehrlich, who proved that mechanical thrombosis could be safely induced.

Safer sclerosants

Safer sclerosants made themselves evident before World War I, and in 1911 Professor Sicard of Paris used sodium salicylate in various strengths This relatively non-toxic substance was in use for some 20 years, but was then replaced by Maingot's lithium salicylate solutions, which were even less toxic and certainly caused less pain In 1921 Génévrier gave to us the well-known solution of quinine and urethane which is still in use today In 1925 Rodney Maingot introduced the "twin injection" method, in which both quinine and salicylate solutions are used simultaneously Invert sugar was introduced in 1917 by Kausche, and, even now, it is still used by some practitioners

Hypertonic sodium chloride

This was employed by Linser in 1924, and in various strengths is employed by many exponents of this therapy today, although owing to the pain produced by the injection its main value lies in its use under general anaesthesia This sclerosant has the added disadvantage of producing a rapid and severe cellulitis and ulceration if introduced under the skin

Sodium morrhuate

Sodium morrhuate in a 5 per cent strength was used in England by Rogers and Winchester in 1930, and also by Kittel and Twistington Higgins This solution is still in use, but is considered to be dangerous by many surgeons

Monoethanolamine oleate

This was described by Biegeleisen in 1937, and is still in use as a sclerosant

Lithocaine

This solution was introduced by Rodney Maingot in 1925, being a modification of the 30 per cent sodium salicylate solution which had been in use for some time at that date Sodium salicylate (Sicard's solution) gave good results but was painful in use Lithocaine has the disadvantage of producing a severe injection ulcer if even a small quantity is introduced extravenously It also produces smarting and burning a few seconds after injection This may last as long as a minute and with large doses makes the procedure uncomfortable for the patient Lithocaine is used with quinine urethane in the "twin injection" technique which will be described later From 2 to 4 millilitres is the average dose for large veins, and it is wise not to exceed 6 millilitres since cases of renal damage are on record We have given up the use of this sclerosant in favour of the phenol solution

Sugar solutions

These solutions are seldom used now since the results obtained are unreliable.

The twin injection method

Reference has already been made to the combined use of Lithocaine and quinine urethane in the treatment of large varices The simultaneous injection of these two substances produces a glutinous mass in the vein and a rapid and very satisfactory sclerosis which sometimes lasts for a considerable length of time If an assistant is available the solutions may be delivered at the same time from different syringes at two points about 1 inch apart As the quinine is "fixed" by the

Lithocaine, up to 2 millilitres of the former may be given and a full dose of up to 4 millilitres of Lithocaine is reasonable When working single handed three syringes are necessary the third syringe containing sterile water Lithocaine is introduced and then sterile water is syringed through the needle in order to clear it of Lithocaine The quinine solution is finally injected through the same needle This method requires rapidity in order to succeed and it should be noted that any toxic effects of a large dose of unfixed quinine may be avoided if the Lithocaine is the first solution to be injected This method has been used ever since it was first described by Maingot 35 years ago He first thought of this method after sucking up some Lithocaine into a syringe wherein were traces of quinine urethane A solid mass was occasioned which made the syringe useless Since it was mine I have always remembered it!

Present position

These and many other sclerosants have been introduced by the patient work of both doctor and chemist. History repeats itself already since modified phenol preparations are once again finding favour with many surgeons

It may be said however that sclerosants if properly selected and used in careful dosages, have become relatively safe. Their use under present-day con ditions is mainly confined to the treatment of small radicles, which have been missed at the time of stripping There is again an indication for their use from the cosmetic angle. Many small but yet unsightly varices may be rendered less obvious and on occasions eradicated if treated carefully by means of injection therapy Larger branches are better treated by surgical excision through small incisions This treatment causes less discomfort and more permanent results

Combination of operative and sclerosant treatment

Some interesting methods have evolved from a combination of both the operative and injection treatments described in this historical survey Tavel, a Bernese professor appears to be the first to have published the results of giving sclerosant injections after operation He employed injections if a firm thrombosis was lacking.

Schiassi however was the originator of the simultaneous ligation and injection of varices He used an iodide solution and the diagram of his method explains his technique (Fig. 39)

This original work of Schiassi was a definite milestone in the treatment of varices He was much in advance of his time, since the marriage of sclerosant treatment with operative treatment did not become firmly established until about 1925

Nobili in 1921 carried Schiassi s work a step further since he performed a retrograde injection from the groin At that time he allowed the sclerosant to leave the vein through a second incision made above the knee

For nearly a quarter of a century subsequently the treatment of varices by means of a high resection of the internal saphenous vein in combination with the retrograde injection of a sclerosant became an accepted therapy throughout the world.

Many ingenious modifications of Schiassi's work followed. It was to Unger in 1927 that we owe the introduction of the catheter for the injection of the sclero- sant this instrument being passed from the proximal end of the saphenous vein

down the leg Later on the catheter was replaced by various types of needles, some rough and some smooth, which were used to introduce the sclerosant and in some instances to traumatize the intima of the diseased vein

The stripping of varices is now an accepted routine treatment in most clinics The method has been in use long enough for us to assess the results, and it is now generally agreed to be superior to all other methods of treatment

The present methods of stripping are associated with a careful high resection of the internal saphenous vein, and it is for this reason that success is obtained in

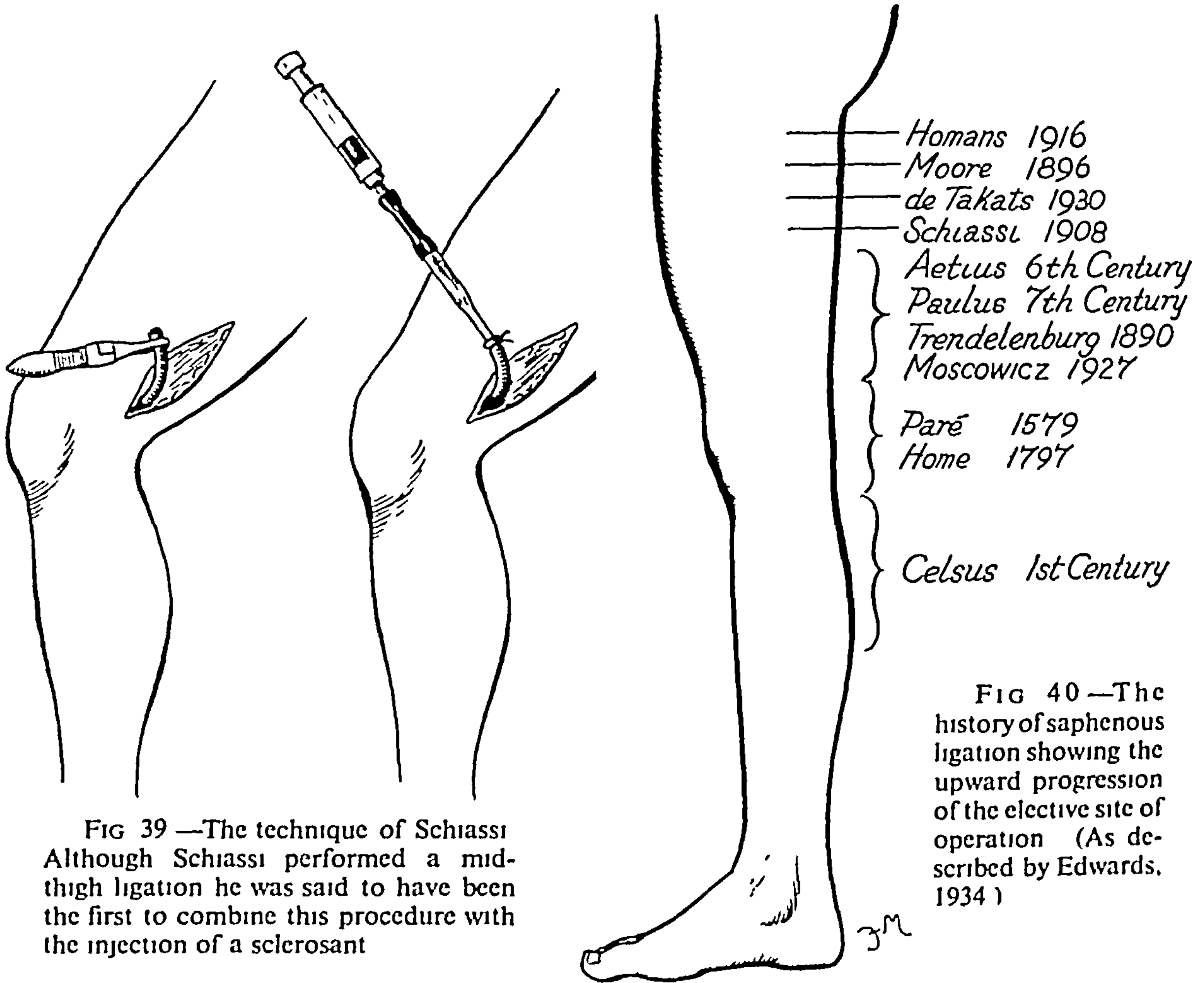


FIG 39 —The technique of Schiassi Although Schiassi performed a mid-thigh ligation he was said to have been the first to combine this procedure with the injection of a sclerosant

FIG 40 —The history of saphenous ligation showing the upward progression of the elective site of operation (As described by Edwards, 1934)

modern times But in this historical chapter we should realize how indebted we are for the accumulated knowledge from the past

Sclerosants should not be banned, as they were towards the end of the last century At that time they were dangerous, but in modern times they are safe, provided they are used correctly They are, however, relegated now to a much more humble sphere, for reasons which will be given later Sclerosants, however, may still be considered to be good friends when it comes to the treatment of varices of a minor character They should not be totally discarded, as they are by so many at the moment While admitting that, as a rule, they give but temporary benefit, most of the troubles associated with their use are due now to their incorrect employment

Many methods of the surgical attack on the distal portion of the saphenous trunk, after the high resection operation were described in the surgical chapter of former editions These I have discarded, in favour of clean stripping I therefore give a list of these methods with a few comments and illustrations for those readers who may still be interested I feel myself however after considerable trial and error that each and every one of these surgical procedures should be relegated to history—even with in some cases a considerable amount of regret and thanks to them for past help

Methods unassociated with stripping

(1) Injection of the distal portion with a sclerosant.

(2) Traumatization of the distal portion with a rough headed needle or with a file. A sclerosant may or may not be injected at the same time.

(3) Electrocoagulation of the intima by means of diathermy

(4) Multiple ligations of the saphenous system

(5) Percutaneous ligations.

(6) The insertion of sutures into the lumen of the vein in order to cause thrombosis.

(7) No further attack on the distal veins at the time of operation

(1) *Injection of the distal portion with a sclerosant*

This method, which was advocated by Dickson Wright and practised at St. Mary s Hospital over the years, consists in the injection of a sclerosant by means of a syringe and needle into the distal segment of the divided saphenous vein. By this method sclerosis is obtained but the results are variable and recurrence over the years may be expected. Again, this method has a disadvantage in the employment of a sclerosant. However in the past many thousands of cases have benefited by this form of therapy

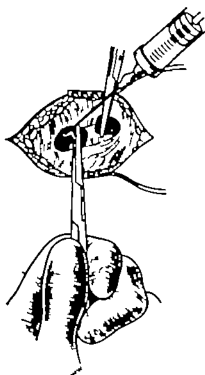


FIG 41 —The injection of sclerosant fluid into the distal portion of the internal saphenous vein by means of a Record syringe fitted with a sharp wide-bore needle This method is quicker and in some hands more simple. It is not so efficient as when using the nutmeg-grater needle.

(2) *Traumatization of the distal portion with a rough headed needle or file a sclerosant may or may not be injected at the same time*

I practised this method for many years and used it so that a smaller amount of sclerosant would be employed. The results of this operation were analysed in 600 patients over a period of several years, and the answers received to a questionnaire were most satisfactory (Foote, 1951) Improvement was the rule and

the majority of ulcerated legs remained healed, although some form of supportive treatment was needed for most of them. I am satisfied now that our immediate results are infinitely better with the stripping technique we now employ and that the outlook for permanent improvement or cure is far better.

(3) *Electrocoagulation of the distal portion by means of diathermy*

Research has been made in the use of diathermy in the destruction of the intima of varices Lang Stevenson in particular worked on this subject for some time In a personal communication he states that he has found this method unsatisfactory when dealing with large varices He finds, however, a place for diathermy in the treatment of minor radicles and also of telangiectases He uses a small needle through which he injects normal saline to rid the vein of blood, and then passes the diathermy current direct into the vein I have had no experience with this method, but it appears that there is some value in this treatment, as far as the cosmetic angle is concerned

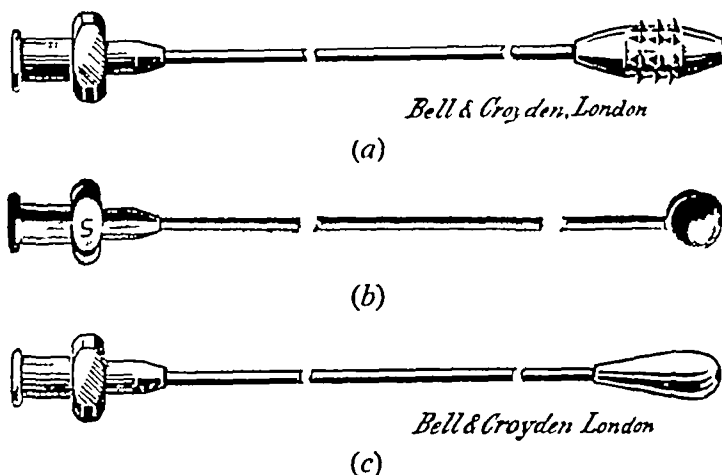


FIG 42—Illustrating types of needle (*a*) The nutmeg-grater needle This needle head is made in various sizes The shaft is made of whippy pliant steel and a useful length is about 14 inches Its correct use will cause a delicate trauma to the venous intima (*b*) The original Stevenson's ball-pointed needle (*c*) A modification of the Stevenson needle by Harold Dodd

(4) *Multiple ligations of the saphenous system*

After high resection of the internal saphenous vein there were those who felt that further ligations of the main trunk and its branches were all that was necessary in order to get good results Surgeons such as Garber (1945) and Hanschell advocated this method for some years In the author's experience multiple ligations are of very little value since recurrence is invariable Some operators perform these multiple ligations every inch or so in the course of the main trunk This laborious procedure appears to be quite unnecessary, when the entire vein can be extracted bloodlessly in a few minutes It should not be forgotten, however, that local ligations render subsequent stripping very difficult and frequently impossible to perform This point is brought out in a letter which I wrote to the *Lancet* (1953) and I think it is of considerable importance

(5) *Percutaneous ligations*

This type of therapy has been advocated by many writers during the past years but in my opinion it is never justified. Rapid recurrence is liable to ensue and the procedure is not without risk Davat (*see* page 28) recommended this surgical trick over 100 years ago but similar references may be found in writings of the Middle Ages Even at the time of writing the second edition in 1954 percutaneous ligation had been revived once more by Wilson (1953) who quoted a series of 50 cases with one death The method consists of making many small incisions on either side of the trunk of the internal saphenous vein and its tributaries and passing subcutaneous nylon ligatures This method produces clotting, but I find it difficult to understand why such a painful and, in my hands useless procedure should be adopted when the entire vein with its tributaries may be painlessly and bloodlessly *removed* usually through two incisions only that in the groin and in the ankle Again in 1956 Uhma and MacDonald advocate this method, and even advise it without the essential high resection operation I condemn this method without reserve

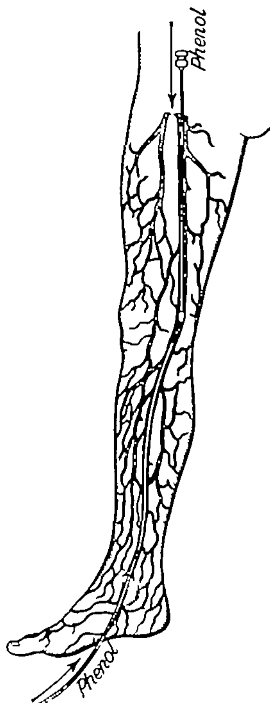


FIG 43—A diagram to demonstrate the introduction of sclerosant by means of the "nutmeg grater" needle from above and the introduction of injection fluid by means of a polythene tube from below

(6) *Insertion of sutures into the lumen of the vein in order to cause thrombosis*

This method was described by Cortes and Rosas (1947) At that time they went into great detail not only regarding the technique of the operation but also gave the end results After trying this method on a few cases I came to the conclusion that this procedure was not really of great value It was however revived by Abraham (1952) who again described this operation in the *British Medical Journal* Those who are interested are recommended to read the work of Cortes and Rosas and Abraham

(7) *No further attack on the distal veins at the time of operation*

Some operators are satisfied to do a flush tie only and to make no further attack on the superficial varices of the limb This method has the advantage of being safe, but in the majority of cases it is quite inadequate There may, however, be an indication for its use in the elderly patient who has a short span of life before him and who may be relieved by this procedure used in combination with supportive measures This simple and safe procedure, as we have said, may be performed under local anaesthesia and is often useful in order to prevent complications A possible reason for our success in certain cases of simple high

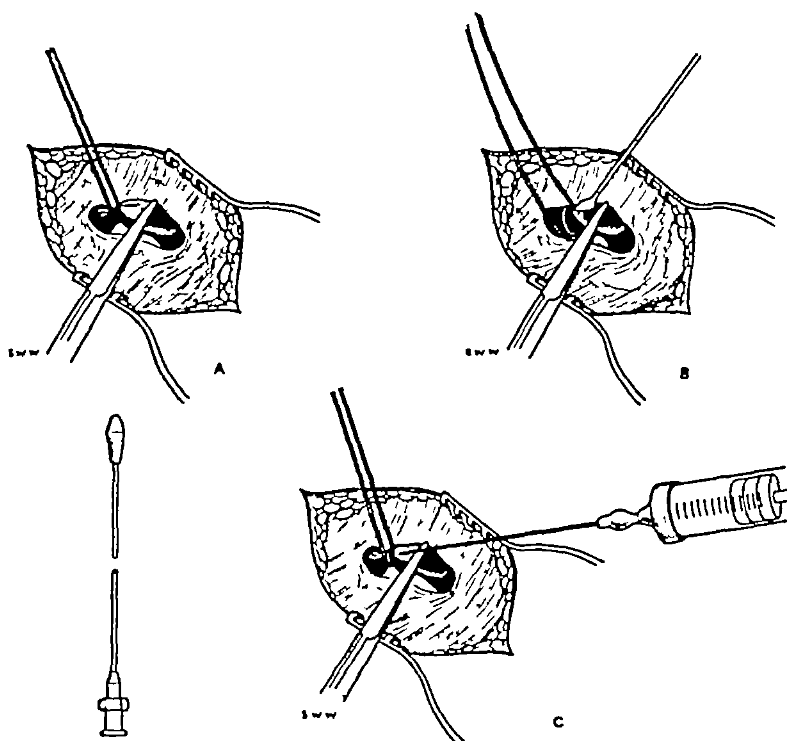


FIG 44 —The introduction of the Stevenson type of needle into the distal portion of the internal saphenous vein This method, which necessitates the employment of a sclerosant, is described in the text, but has been discarded by the author in favour of stripping procedures

resection of the internal saphenous vein may be due to the fact that there were no incompetent perforators below that level Now that we are stripping completely we obliterate the majority of these by-passing channels and make more sure of our results, whereas with previous treatment it was very much less reliable Again, a simple flush ligation at the sapheno-femoral junction is the treatment of choice in acute phlebitis of the superficial veins This matter will be raised again in a later chapter I do feel, however, that the high resection operation by itself cannot be considered an adequate operation in incompetency of the superficial system It is for this reason that I relegate it to the historical chapter

Evolution of modern methods

The variations in the treatment of varicose disease present a story of uphill work under difficult conditions in the past, associated with the lack of asepsis,

and of those things which in our present times make our treatment so much safer and easier The surgical excisions and strippings, in the pre-anaesthetic and pre antiseptic times, have all been a help to us at a later date

Sclerosants have had a chequered career being discarded towards the end of the last century re-introduced some 30 years ago and now, after prolonged trial and error once again being relegated to a far less important position than they enjoyed in the past. The use of sclerosants in association with operative treatment stood



FIG 45 —The Trendelenburg operation performed at the present time The scar of operation in the upper third of the thigh is placed in the area of attack which was standard in the days of Trendelenburg in 1870 This operation was, however performed in 1948 This photograph demonstrates the uselessness of this procedure which at the very best will give but a temporary degree of relief

the test of many years but once again this treatment has become of historical interest only History repeats itself throughout the centuries but it is suggested that the present era is one which holds out a far more optimistic future for the sufferer Further research should proceed with regard to the aetiology and subsequent prevention of this disease This research should go hand in hand with the refinement of our present-day techniques The treatment of varices will never lose its fascination since history shows us that the therapy of the varix is always progressive and never static

Present-day methods are the summation of the varied therapies of the past The "flush tie" or high resection of the internal saphenous vein was envisaged by Paul of Aegina one thousand two hundred years ago, made more definite by Moore of Melbourne during the last century, and finally perfected by Homans some forty odd years ago. Stripping operations have figured in varied techniques ever since the days of Hippocrates It is only in recent times, however, that this method has been made safe As mentioned before, sclerosants have come, gone, returned to favour and in our present times occupy only a very minor place in treatment

I have not altered this chapter to any great extent since first writing it in 1948, but readers interested in history will find that it has been reproduced in contemporary books on the subject, in which further interesting details may be found

The help we have had from the pioneers of the past now allows us to state that all sufferers from varices can be benefited, and it is hoped that this historical chapter will in some small part help to show our gratitude to those who have made our work possible

BIBLIOGRAPHY AND REFERENCES

Abraham, A J (1952) "New Operative Method of Causing Thrombosis in Varicose Veins" *Brit med J*, 2, 260

Anschutz, W, and Lohr, W (1929) "Injektion Behandlung der Varicen" *Zbl Chir*, 56, 3211

Babcock, W W (1907) "A New Operation for the Extirpation of Varicose Veins of the Leg" *N Y med J*, 86, 153

— (1935) *A Textbook of Surgery*, 2nd ed Philadelphia, Saunders

Baynton, T (1797) *Descriptive Account of a New Method of Treating Old Ulcers of the Legs* London, Robinsons

Berntsen, A (1927) "Des Varices du Membre Inferieux" *Acta chir scand*, 62, 61

Buck, A H (1917) *The Growth of Medicine*, p 379 New Haven, Conn, Yale University Press

Colt, G H (1928) "The Modern Treatment of Varicose Veins" *Brit med J*, 2, 525

Cortes, S T, and Rosas, A P (1947) "The Surgical Therapy of Varices of the Lower Extremities by Inclusion of Foreign Bodies (Suture Threads) According to the Triana Cortes Technique" *Rev Fac Med, Bogotá*, 15, 629

Edwards, E A (1934) "The Treatment of Varicose Veins" *Surg Gynec Obstet*, 59, 916

Faxon, H H (1934) "Treatment of Varicosities" *Arch Surg, Chicago*, 29, 794

Fields A (1950) "Varicose Veins, Early Studies and Treatments" *Ann west Med Surg*, 4, 403

Foote, R R (1944) *Varicose Veins, Haemorrhoids and Other Conditions Their Treatment by Injection* London, Lewis

— (1947) "The Bandage in Varicose Conditions" *Practitioner*, 158, 60

— (1951) "Some Reflections on the Operative Results Obtained on 600 Varicose Limbs" *Practitioner*, 166, 244

— (1953) "Surgical Treatment of Varicose Veins" *Lancet*, 2, 784

Garber, N (1945) "Varicose Veins in the Lower Limb" *Clin Proc, Cape Town*, 4, 200

Garrison, F H (1929) *Introduction to the History of Medicine*, 4th ed Philadelphia, Saunders

Gay J (1868) "On Varicose Diseases of the Lower Extremities" *The Lettsomian Lectures of* 1867 London, Churchill

Genevrier, M (1921) "Du Traitement des Varices par les Injections Coagulantes" *Soc de med mil franç* 15 169

Gross, S D (1882) *System of Surgery*, 2, 1048 6th ed Philadelphia, Lea

Hesse E, and Schaack, W (1921) "Die anatomisch-physiologische und Klinische Bewertung der Sapheno-femoralen Anastomose bei Varicen" *Beitr klin Chir*, 124, 1

Higgins T T and Kittel, P B (1930) "The Use of Sodium Morrhuate in Treatment of Varicose Veins by Injection" *Lancet*, 1, 68

CHAPTER 3

THE SURGICAL ANATOMY OF THE VEINS OF THE LEG

Classification

IT IS necessary to have a comprehensive knowledge of the venous system of the leg in order to understand the substance of the ensuing chapters The anatomy of the saphenous opening and a discussion on the deep venous system will be given in as much detail as possible

The veins which drain the lower extremities may be conveniently divided into four main groups

(1) The deep veins of the leg, such as the femoral, popliteal and tibial

(2) The superficial veins which empty into the femoral vein at the saphenous opening (the internal or long saphenous system)

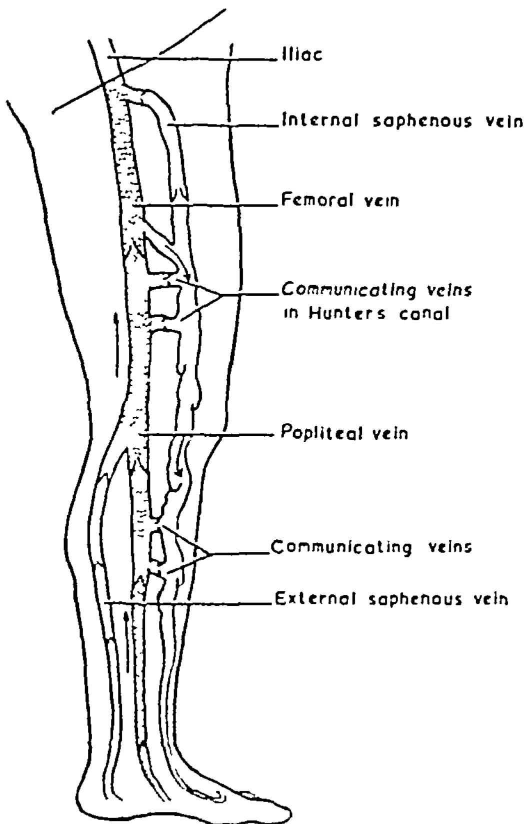


FIG 46—Diagram showing the relationship of the deep venous system to the superficial veins Varicose disease and the communicating veins between the two systems are depicted The constant communicating vein in Hunter's canal when diseased is sometimes referred to as the "mid-Hunter blow out" In health, blood passes *from* the superficial system into the deep veins via the communicating veins

(3) The superficial veins which empty into the popliteal vein (the short or external saphenous system)

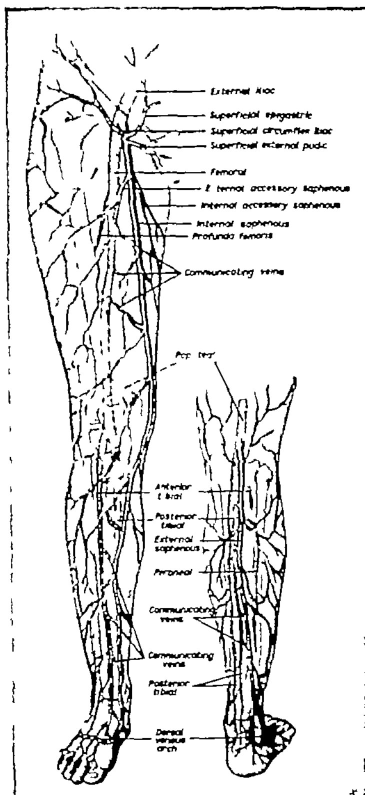
(4) Those deep and superficial veins which empty direct into the internal iliac vein These drain the buttocks and posterior part of the thigh.

These four groups of veins are by no means in watertight compartments All the superficial groups anastomose with their neighbours, whilst the superficial and deep groups are connected by *communicating veins* The significance of these communicating veins has been increasingly realized in recent years and they will therefore be discussed under a separate heading

The communicating veins

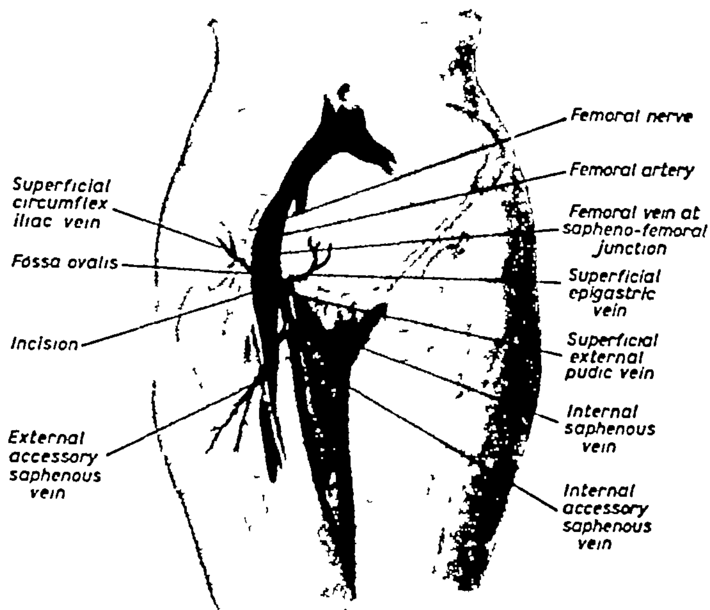
In addition to the four groups as detailed the communicating veins also play a most important part in the venous system of the lower extremity These veins connect the deep with the superficial venous system (Fig 47) In health these veins are small and their minute ostia may be seen in the posterior walls of the superficial

PLATE II



The internal and external saphenous veins.

Reproduced from "Semaine Internationale" by courtesy of the publishers



The surgical anatomy at the sapheno-femoral junction

Reproduced from " Seminar International " by courtesy of the publishers

system In varicose disease these communicating veins become enlarged and later their valves become incompetent Their importance will be appreciated when the operative side of varices is discussed In health blood flows from the superficial to the deep system. It will be seen later that when veins are diseased this flow may become reversed.

It is of interest to note that although the anatomy of the superficial venous system of the lower extremities is most inconstant and variable, these communicating veins are far more constant and variations in their position are not nearly so usual One important communicating vein is referred to in American literature as the mid Hunter blow out and is usually constant in its position lying at the



FIG 47 —Phlebogram of a healthy limb demonstrating the communicating veins between the deep and superficial venous systems of the leg.

junction of the lower third with the upper two-thirds of Hunter s canal Sherman (1944) proved this vein to be constantly present in 56 consecutive anatomical examinations He also found a further constant tributary of this mid Hunter vein which drained the sartorius muscle He refers to this particular vein as the subsartorial Ochsner and Mahorner (1939) after extensive dissections, found only a few extremely minute orifices on the posterior wall of the internal saphenous vein.

Also it is interesting to note that owing to the fact that part of the blood is deflected from the superficial to the deep system by means of these communicating veins, the great saphenous vein does not increase so much in size as one might expect from the very large number of tributaries which join it.

Linton stressed the importance of perforating veins in the leg as a cause of ulcer which he showed in the course of his dissection beneath the deep fascia (' feeder veins ') whilst Cockett and Elgan Jones (1953) by careful dissection and excellent photography have shown these veins as they pass through the deep fascia (*see* Fig. 48) They state that there are three constant perforating veins behind the posterior margin of the tibia in the lower third of the leg not communicating directly with the saphenous vein. They report cases of ulcers little improved by operating upon the saphenous vein but healed by ligation of the

incompetent communicating veins in the lower leg This condition they have named the *ankle blow-out syndrome*, and this will be referred to again later

Both " perforator " and " communicating " veins anastomose with the superficial venous system and are in fact similar The author, however, tends to reserve the term " perforator " for the vein which anastomoses with the lesser unnamed radicles of the saphenous system By comparison the communicating

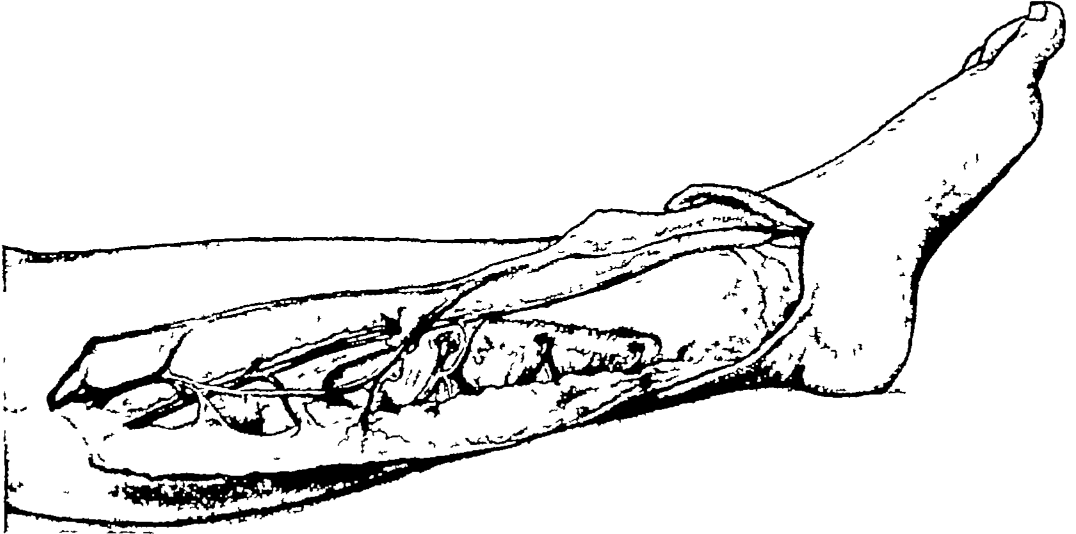


FIG 48 —Dissection of subcutaneous tissues of inner side of normal leg, showing three perforating veins behind great saphenous vein Note (1) communicating branch between highest perforating vein and great saphenous vein, and (2) tributaries to great saphenous vein just below knee

vein does what its name implies and communicates directly from the deep system to the internal or external saphenous veins

Perforating veins pass from a branch of a superficial vein to join up with the large veins in the muscular bellies of the calf or thigh They are not constant in position and may be very numerous

The true *communicating vein* is far more regular in its position in the limb The usual sites for these veins are shown in Figs 47 and 49

The lower three communicating veins in the inner side of the leg are the most important from the point of view of ulceration When the patient stands the main venous drainage of the lower third of the limb passes directly into the deep veins and not into the saphenous veins Back pressure from the saphenous veins, however, can be transmitted into the ulcer-bearing area via their connexions with the venous arches joining these communicating veins It pays us all to study Fig 49, and to familiarize ourselves with the usual positions of the main communicating veins In disease these positions can usually be felt Under the " blow-out " made by the incompetent communicating vein there is a round hole with rigid walls formed by the deep fascia It is of interest to note that a hundred years ago John Hilton virtually described the " ankle blow-out syndrome " He said " The superficial and deep veins of the leg freely communicate with each other in the neighbourhood of the ankle joint The first two inches above that

point is the spot where the greatest stress is laid upon these superficial veins Below that point they freely communicate and if the blood cannot return by the superficial veins it can do so by the deep veins "

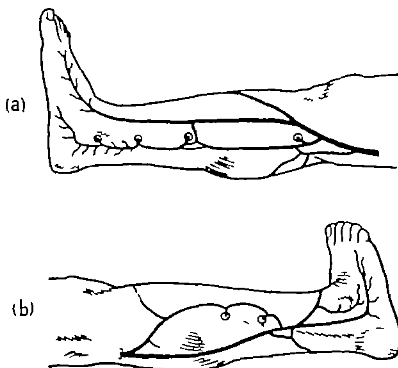


FIG 49 —The common positions for blow-outs. (*After Cockett and Jones*)

The deep veins of the leg

The deep veins of the leg are seldom the seat of varicose disease The main factor in causing their immunity is to be found in the support they receive throughout their course both from the deep fascia and from the muscles In the lower as in the upper limb the deep veins are associated with the arteries as venae comites They carry most of the blood from the leg to the vena cava. Their detailed anatomy is not required in the study of varices, and it is sufficient to say that the accompanying veins of the tibial arteries are usually reduplicated, one lying on either side of the artery Union occurs higher in the leg in order to form a solitary anterior tibial vein and a single posterior tibial vein These tibial veins form a junction to the lower part of the popliteal space, being continued upward as the popliteal vein In passing, it is to be noted that it is in these anterior and posterior tibial veins that we frequently find the earliest evidence of thrombophlebitis

As the popliteal vein ascends in the popliteal space it inclines towards the outer side of the popliteal artery lying directly behind it in the middle of the space At the upper end of this space it is on the outer side of the artery separating it from the internal popliteal nerve, which lies still more posteriorly After passing through the adductor magnus muscle it becomes the femoral vein which after its passage through Hunter s canal appears in Scarpa s triangle, in which position its relations

are of particular importance when operating on the internal saphenous vein In the lower part of Scarpa's triangle the vein is behind and to the inner side of the femoral artery, lying in front of the profunda vein, but in the upper part of Scarpa's triangle it is directly on the medial side of the femoral artery About 1½ inches below Poupart's ligament it enters the middle compartment of the femoral sheath with the femoral artery on the outer side and the femoral canal on the medial side, both in their separate compartments The femoral and popliteal channels are variable in their make-up Instead of one large ascending vein it is not uncommon to find reduplication of venous channels in which one single main channel is difficult to define

Throughout its course the femoral vein receives muscular tributaries corresponding to the branches of the femoral artery, the most important of these being the *profunda femoris vein* which joins its posterior surface 2 inches below the inguinal ligament This deep vein anastomosis in Hunter's canal with the femoral vein is important, since it offers a collateral venous return when the femoral vein is blocked by thrombosis This constant communication is of importance also in the stripping of varices Care should always be used when the stripper wire is in this neighbourhood First, it may become obstructed at this point and need to be " wheedled " gently past this obstruction Furthermore, on occasions the stripper wire may pass into the deep system at this point This eventuality is discussed in the surgical chapter Slightly above this level the internal saphenous vein joins its anterior surface at the *sapheno-femoral junction*

Since we shall study in Chapter 4 the mechanism of the " muscle pump " of the calf, it is as well at this point to study the venous drainage of the gastrocnemius and soleus muscles

The *soleus* muscles contain large venous sinuses which do not contain any valves These sinuses drain into the posterior tibial and perineal veins, and are of importance not only from the muscle pump angle but also because these are the pools of blood which may become the site of thrombosis after operation

The *gastrocnemius* muscle One large vein from each of the two muscle bellies drains directly into the popliteal vein

Valves are present throughout these deep veins from the finest vein radicles in the muscles, where they are seen only with the microscope, to the larger veins where they are present in varying numbers The popliteal vein has 1–4 pairs, the superficial femoral 1–5 pairs, the common femoral and the external iliac each usually only one pair One of the most constant is the valve in the common femoral vein which is situated at the level of the inguinal ligament The next most constant is one in the superficial femoral vein distal to the point of entry of the deep femoral Complete absence of valves in the external iliac and common femoral veins is, however, by no means uncommon No valves are present in the common iliac veins or in the inferior vena cava

Relationship to fascia of the groin

The relationship of the femoral vein to the fascia of the groin is of importance when we come to consider operative technique The superficial fascia of the groin is divided into two layers, a superficial fatty layer and a deeper membranous layer The latter is attached above to the inner half of Poupart's ligament and to the deep fascia of the thigh immediately below the outer half of this ligament Between

the two layers of this superficial fascia may be found the femoral and inguinal lymphatic glands together with the long saphenous vein and its tributaries The deep fascia, or as it is more commonly known the fascia lata, forms a tubular covering not only for the muscles of the thigh but also for the vessels In the groin the deep fascia is thick, and in many places both nerves and vessels pierce it.

The saphenous opening

The opening through this deep fascia, the saphenous opening, allows the internal saphenous vein to join the femoral vein (Fig. 50) The saphenous opening is variable in size. Anson and McVay (1938) published their findings upon dissections of 200 thighs The smallest saphenous opening encountered measured

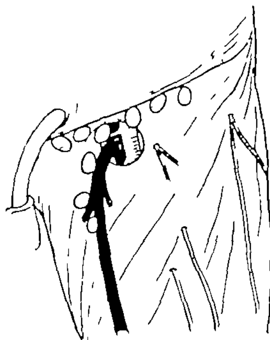


FIG 50—The saphenous opening. Note the manner in which the deep fascia forms the ring. The angle of union of the internal saphenous vein with the common femoral vein is clearly shown.

The position of the lymphatic glands is important and the operation may be complicated if these glands are inflamed as the result of absorption from either a varicose ulcer or from tinea interdigitalis.

1 6 centimetres in length being quite circular in form the largest was 8 5 centimetres long and 3 5 centimetres wide In 90 per cent of cases the length was between 3 and 6·4 centimetres the average being 4·6 centimetres and in 87 per cent of cases the width was between 1 5 and 3 9 centimetres the average width being 2 8 centimetres The femoral vein was found to be exposed throughout its full width. In 83 per cent of specimens the femoral artery was either wholly or partially exposed. The surface markings of the superior cornu of the saphenous opening may be taken as being 1 5 centimetres below and 2 5 centimetres external to the pubic spine. It is covered not only by the superficial fascia of the thigh but also by a special layer known as the cribriform fascia, which is attached to the edges of the opening. The outer edge of the saphenous opening is formed by the iliac portion of the fascia lata which is attached above to the iliac crest and to Poupart s ligament the inner edge is made up from the margin of the pubic portion of the fascia lata. The junction of these two portions of fascia at the lower concave edge of the saphenous opening forms the inferior cornu The superior cornu of the saphenous opening, which lies in front of the femoral sheath is formed solely from the iliac portion of the fascia lata. It should be noted that the iliac and pubic portions of the fascia lata occupy different planes in relation to the femoral sheath The iliac portion is anterior and the pubic portion is posterior As mentioned before these points all have a bearing on the surgical approach to the sapheno-femoral junction

The lymphatic glands

The position of the lymphatic glands should be especially noted (Fig 50) The superficial group may be subdivided into

(a) The superior or inguinal group
(b) The inferior or femoral group.
(c) The internal or pubic group

These glands may become much enlarged and adherent to adjacent structures as a result of infection from varicose ulceration, eczema and tinea interdigitalis It is the inferior or femoral group which covers the sapheno-femoral junction and which consists of from 3 to 6 oval glands lying vertically along the termination of the internal saphenous vein

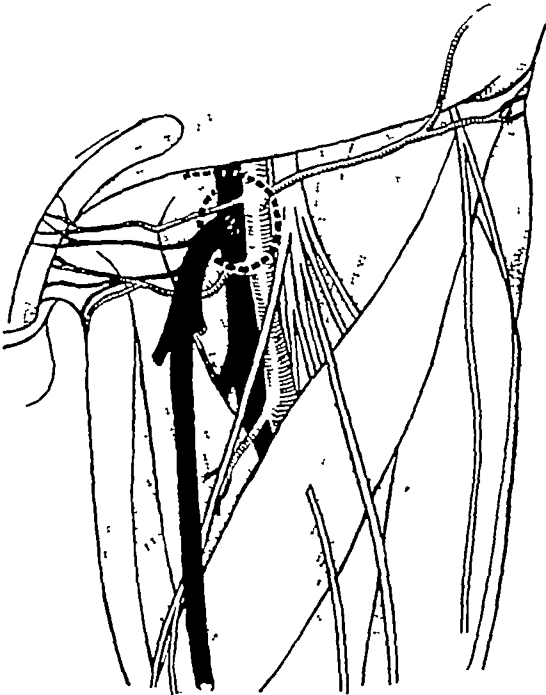


FIG 51 —Scarpa's triangle The position of the saphenous opening is marked with a dotted line and the position of the femoral vein and femoral artery should be noted

Note the angle at which the saphenous vein joins the femoral vein When in doubt the inward direction of the saphenous vein is an important point of differentiation from the femoral vein When this vein is found to be varicosed it is an additional point of differentiation The femoral vein does not receive any tributaries at this point and this fact gives further confirmation regarding differentiation in doubtful cases.

The superficial lymphatics from the leg, except for a few which end in the popliteal glands, all drain into this femoral group The efferent lymphatics of this inferior group pass through the saphenous opening and end either in the external iliac glands or in the deep femoral glands It will be found when discussing the surgery of this region in a later chapter that care must be taken not to divide these lymphatics transversely if chronic lymphorrhoea and bad healing of wounds are to be avoided

The internal or long saphenous vein system

It is the internal and external saphenous venous systems which are the commonest sites of varicosities The long or internal saphenous vein is the longest vein in the human body (Fig 52*a*) It is formed by the union of the inner portion of the dorsal venous arch with the inner dorsal digital vein of the great toe The blood draining into these branches comes mainly from the venous plexus in the sole of the foot This " venous sole " (*semelle veineuse*, Lejars) consists of a vascular network which is most well developed in those areas which are exposed to pressure on walking Through the perforating veins this vein-net anastomoses vertically with the dorsal net This anatomical arrangement plays an important part in the venous circulation of the foot

Its passage in front of the internal malleolus should be especially noted since at this point a lower ligation of the vein for the purpose of introducing the stripper is so frequently performed The position of the vein is constant at this point and may be felt lying in the notch half an inch anterior to the most prominent portion of the internal malleolus (Fig 53) After this landmark the vein crosses the inner surface of the shaft of the tibia and follows the internal border of this bone to

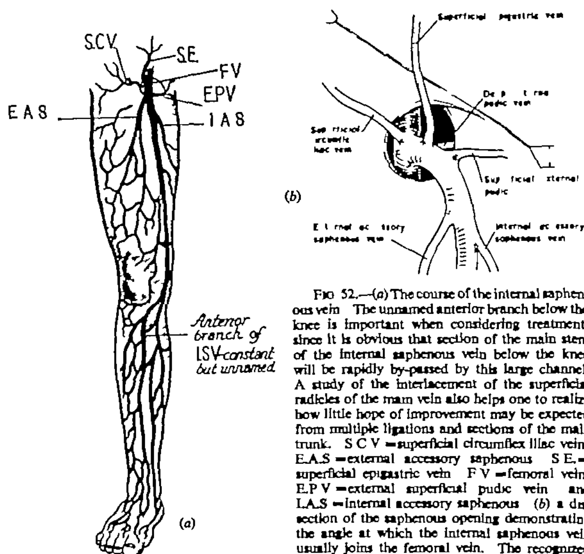


FIG 52.—(*a*) The course of the internal saphenous vein The unnamed anterior branch below the knee is important when considering treatment, since it is obvious that section of the main stem of the internal saphenous vein below the knee will be rapidly by-passed by this large channel A study of the interlacement of the superficial radicles of the main vein also helps one to realize how little hope of improvement may be expected from multiple ligations and sections of the main trunk. S C V =superficial circumflex iliac vein E.A.S =external accessory saphenous S E.= superficial epigastric vein F V =femoral vein E.P V =external superficial pudic vein and I.A.S =internal accessory saphenous (*b*) a dissection of the saphenous opening demonstrating the angle at which the internal saphenous vein usually joins the femoral vein. The recognized tributaries are depicted.

knee level, where it is to be found just behind the internal condyle of the femur In its subsequent ascent it inclines forward and outward until it perforates the cribriform fascia and the femoral sheath before its union with the femoral vein When resecting this vein in the lower leg it should be remembered that the internal saphenous nerve accompanies it very closely This relationship is of particular interest, since it has been suggested that section of this nerve may be an additional help in the healing of varicose ulcers Again, a severe phlebitis may affect this nerve and leave a post phlebitic neuritis as a late complication Also just below the knee a superficial branch of the anastomotic artery accompanies the vein very

closely During its ascent in the thigh, branches of the internal cutaneous nerve are in juxtaposition

The anatomy of the internal saphenous vein is variable, and only the most constant points regarding its course have been mentioned up to now



FIG 53 —The internal saphenous vein at the ankle The surface marking is given by feeling the most prominent part of the internal malleolus The vein lies immediately in front of this point A transverse incision makes it easier to find the vein but has the disadvantage over the vertical incision in that healing is less satisfactory

Tributaries of the internal saphenous vein

The tributaries of the internal saphenous vein are very variable, both in number and in position Some of the more constant patterns of the saphenous network are shown diagrammatically in Fig 54 In the meantime we must recognize that at the sapheno-femoral junction (*see* Fig 52*b*) there are usually five tributaries, or rather five groups of tributaries (1) The external accessory saphenous vein, (2) the internal accessory saphenous vein, (3) the superficial circumflex iliac vein, (4) the superficial external pudic vein, and (5) the superficial epigastric vein

It is *essential* in the operation of high resection of the internal saphenous vein to ligate every tributary with meticulous care It will be found in the surgical chapter (Chapter 8) that we must go further than actually resecting the branches at their junction with the main trunk Fig 56 demonstrates how by-passing may occur even after a "flush" ligation with the trunk The diagram, I hope, is self-explanatory

Another fairly constant but unnamed tributary of the internal saphenous vein unites on the postero-medial aspect of the knee This tributary drains blood from the anterior surface of the lower leg and may become sufficiently enlarged to appear to reduplicate the main vein below the knee On page 189 the reader will find some common patterns of the tributaries of the internal saphenous vein in the

course of its journey up the leg These veins when varicose all have to be stripped, but it is useful to visualize their usual positions After stripping a large number of limbs we find the patterns recurring like old friends

Below the knee as mentioned we find the large unnamed branch which drains the anterior portion of the shin Likewise a fairly constant branch occurs at the same point which drains the postero-medial aspect of the calf

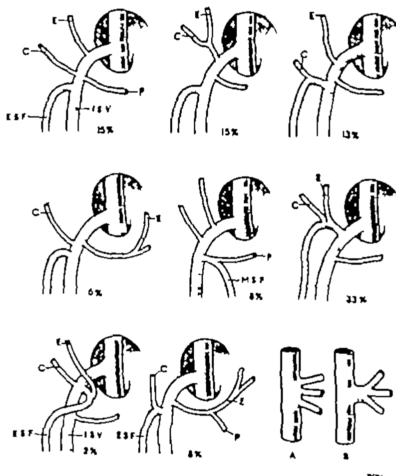


FIG 54 —Some of the varied methods of termination of the internal saphenous vein and its tributaries. These diagrams are copied from those described by Daseler and his colleagues and are the result of extensive investigations on both cadavers and patients. These varied methods of entry of the tributaries of the internal saphenous vein show that few cases subjected to operation prove to be similar Again tortuosities and saccular dilatations may occur in the branches, causing them to be even more prominent than the internal saphenous vein itself A knowledge of these variations is of little surgical importance since every branch entering at the saphenofemoral junction should be ligated and divided

In the thigh there are many tributaries but the *internal and external accessory* saphenous veins are constant These join usually within a few inches of the termination of the internal saphenous vein and are usually resected or stripped prior to the stripping of the main trunk The nomenclature is confused since writers refer to these two branches as superficial internal and external femorals

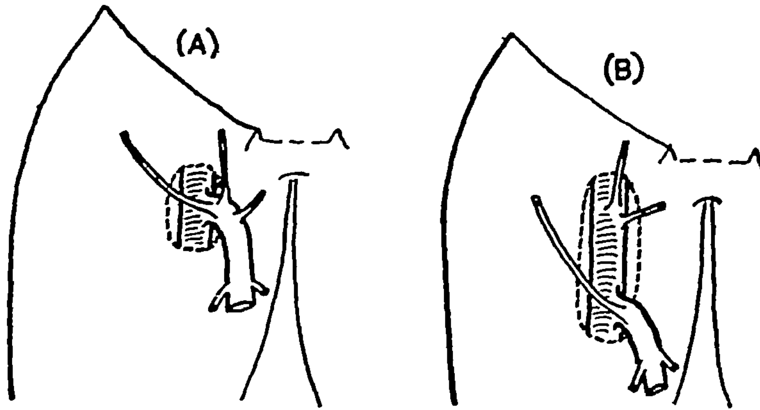


FIG 55 —(A) The normal arrangement at the sapheno-femoral junction (B) An important example of the vagaries of the internal saphenous vein It passes lateral to the femoral artery and joins the femoral vein deep to the artery The superficial external pudendal and superficial epigastric veins are seen to be entering the femoral vein directly, the superficial circumflex iliac vein and the internal and external accessory saphenous veins are entering the internal saphenous vein The fossa ovalis is long and narrow

A J. M Cathro (1954) in the *British Medical Journal* writes as follows " Luke and Miller (1948) cited three certain cases and one probable case of ligation of the femoral artery McPheeters (1945) described two cases of ligation of the femoral artery, and in one of these cases the femoral vein was also tied At least three cases have come to my notice in this country in which either injury or ligation of the femoral artery occurred during this operation For obvious reasons it is difficult to get details of the operative findings, but it is possible that the anomaly described above may have been present in some of these cases

" A somewhat similar course of the long saphenous vein was described and illustrated by von Lanz and Wachsmuth (1938) It was also depicted in Fig 5 of an article by Anson and McVay (1938) so that it cannot be exceptionally rare No mention was made of its significance in either of these texts

" Whatever the explanation of the surgical errors associated with Trendelenburg's operation it is obvious that the surgeon should be aware of the deceptive variation described in this report The technical difficulties which it presents are slight The real danger lies in not knowing that such a condition may exist "

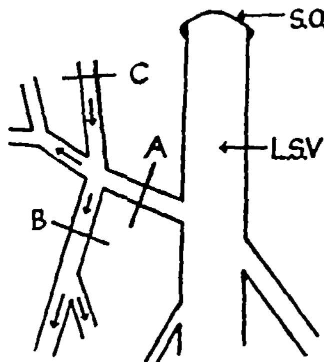


FIG 56 —Ligation of branches of long saphenous vein A = site of usual ligation B, C = additional ligatures needed to prevent bypass L S V = long saphenous vein S O = saphenous opening

postero-medial and lateral veins etc. I feel that the term I use is the least confusing

The *postero-medial branch* (*see* Fig 57) is of importance since it may be quite large It arises from the external saphenous vein and travels up the back of the thigh before joining the internal saphenous vein in the course of its upper third prior to its junction with the femoral vein Various investigators have reported



Fig 57—The right leg shows massive varicosity of the postero-medial accessory vein originating in Hunter's canal. This is a tributary of the internal and not the external saphenous vein, although the latter may have some small communication with the varices.

on the percentage of patients who present a double internal saphenous vein in the thigh One authority found this condition to be present in 6 5 per cent of cases

Valves

The internal saphenous vein is liberally supplied with valves having 12–18 pairs which normally prevent any reflux of blood towards the foot.

The short or external saphenous system

The external saphenous vein in health is a separate entity from the internal saphenous vein In the varicose state, however the two systems may become one

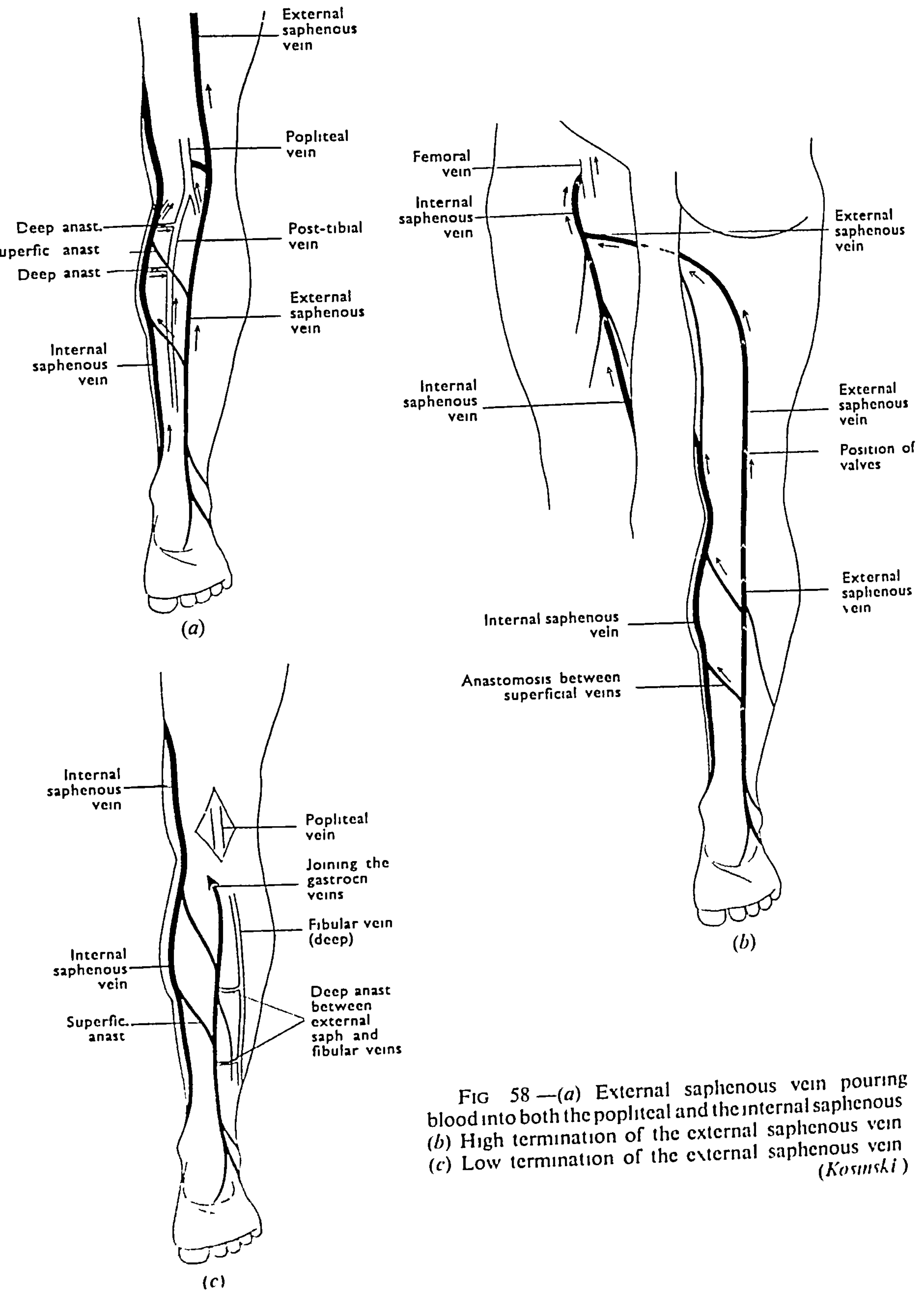


FIG 58 —(*a*) External saphenous vein pouring blood into both the popliteal and the internal saphenous (*b*) High termination of the external saphenous vein (*c*) Low termination of the external saphenous vein (*Kosinski*)

This is due to the fact that communicating veins between the two systems which are relatively functionless and small in health become active when enlarged by varicose disease A fairly constant communication between the two systems is that which occurs over or just above the patella. This communication joins the external saphenous vein just before its termination The external or short saphenous vein is formed by the joining of the outer part of the dorsal venous arch with the outer dorsal digital vein of the little toe The vein passes posteriorly in company with the external saphenous nerve along the external side of the foot. It then passes below the external malleolus and along the outer edge of the tendo achillis This is an important landmark since at this point the vein is easy to isolate in order to introduce the stripper At this point also an extended incision will allow the excision of incompetent communicating veins At the back of the calf it is accompanied by the superficial sural artery and at the union of the muscular and tendinous part of the gastrocnemius muscle, about mid-calf it ascends in an intra fascial compartment of the gastrocnemius muscle covering During this part of its course it is well supported by a strong fascia The external saphenous vein in about 60 per cent of cases joins the popliteal vein half an inch below the transverse skin crease behind the knee Owing to its strong fascial support it should be noted from the practical angle that the knee should always be bent if easy palpation of the vein is required It should be most especially noted that after piercing this deep fascia the vein runs for some distance under this unyielding tissue from which it gains considerable support This anatomical fact is of importance in treatment since unlike the internal saphenous vein at its termination it is subjected to much less alteration in pressure from strain since this protection of the fascia acts like a valve The tributaries are very variable, but one descending from the back of the thigh is not uncommon The variations in the termination of the external saphenous vein are important, since they make the surgery of the external far more difficult than that of the internal saphenous vein *Recurrence after resection and stripping of the external saphenous vein is in my experience far more common than it is with the internal saphenous vein* This is not to be wondered at when various anatomical authorities give statistics showing that in a third of cases the termination occurs in the centre of the thigh and in 10 per cent of cases it will end in the upper third of the lower leg, either joining the internal saphenous vein or the deep veins of the calf Reference to the normal high and low termination of the external saphenous vein will be made in the surgical chapter (Chapter 8)

Valves

Valves are present and 8–10 pairs are usual.

Direct tributaries to the internal iliac vein

The postero-mesial and subgluteal regions of the thigh are drained by veins which enter the internal iliac vein posteriorly through the pelvis These groups of veins are (1) Superior gluteal (2) inferior gluteal and (3) internal pudic

Superior gluteal vein

This drains blood from the skin over the gluteal group of muscles These veins when varicose may connect with other superficial veins of the thigh

Inferior gluteal vein

This vein receives tributaries from the superficial veins of the thigh posteriorly and empties into the internal iliac vein directly.

Internal pudic vein

This vein may anastomose directly with the external pudic vein, since it receives tributaries from the skin over the perineum and genitalia It thus establishes a communication with tributaries of the internal saphenous vein and itself empties directly into the internal iliac vein The internal pudic or pudendal veins and the gluteal veins are important in some cases of varicosis, since their skin-branches often become varicose when the common or internal iliac veins are interfered with either by thrombosis, pressure from a pelvic tumour, or by pregnancy The internal pudic or pudendal veins particularly affect the labia, whereas the gluteal veins appear below the gluteal fold

HISTOLOGY AND EMBRYOLOGY OF THE SAPHENOUS VEINS

Histology

Fig 59 demonstrates the three layers which are present in a normal vein

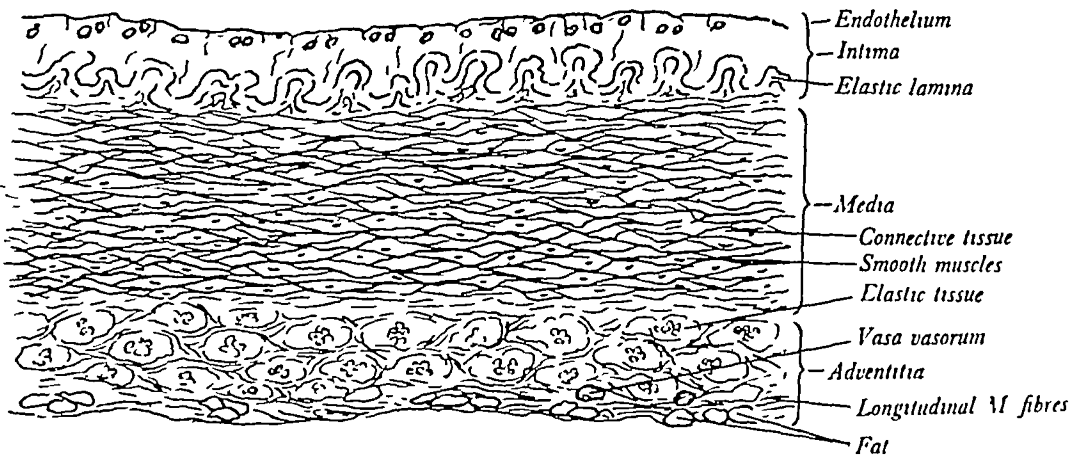


Fig 59 —Diagram showing the three layers to be found in normal vein tissue Subsequent microphotographs will show how varicose disease modifies the orderly arrangement of these layers

The intima

The intima consists of a layer of flat endothelial cells forming a delicate membrane which, in certain positions, is thrown into folds in order to form valves It is this intima which becomes damaged as a result of sclerosant therapy The intima is supported on a fine layer of connective tissue containing bundles of smooth muscle fibres running in the longitudinal axis of the vein There is a zone of fine elastic fibres immediately under the endothelium, and this is known as the external elastic lamina or membrane

The media

The media or middle portion of the vein wall is the thickest, and in it may be found muscle bundles running obliquely to the long axis The muscle fibres are

surrounded by a good deal of connective tissue It should be noted that the media is found to be better developed in the internal saphenous veins than in any other vein in the body

The adventitia

The adventitia or outer layer of the vein wall consists of both elastic and fibrous tissue in conjunction with a small amount of muscle tissue In this layer lymphatics sympathetic nerve endings and vasa vasorum may be found. These



FIG 60 —Section of a normal vein. Three layers of wall can be distinguished intima, media and adventitia.

vasa vasorum form numerous connexions with the capillaries of the nearby tissues It will thus be seen that the secondary results of infection and stasis in the main vein may be thus transmitted to the surrounding tissues and cause pathological changes

Venous valves

The venous valve is a pouch like fold of the tunica intima occurring at various levels in the main veins of the lower limb These valves are generally bicuspid though occasionally tricuspid. The free border of the valve is lunate As previously mentioned, a valve is merely a fold in the intima of the vein which usually presents a deep concavity They were first described by Fabricius of Aquapendente in the early seventeenth century Their importance was not made evident until 1628 when William Harvey realized their significance The presence of a valve may be noted from the outside of the vein owing to the fact that on the heart side of the valves the vein wall is usually thinned, allowing a certain amount of dilatation. This gives a somewhat nodular effect to the vein when it is full of blood

Luke, J C, and Miller, G G (1948) "Disasters following the Operation of Ligation and the Retrograde Injection of Varicose Veins" *Ann Surg*, **127**, 426
McPheeters, H O (1945) "Sapheno-femoral Ligation with Immediate Retrograde Injection" *Surg Gynec Obstet*, **81**, 355
Meisen, V (1932) *Varicose Veins and Haemorrhoids* London, Oxford University Press
Mériel, P (1927) "Note sur les Distances Valvulaires dans quelques Veines" *Arch Anat, Strasbourg*, **6**, 99
Ochsner, A, and Mahorner, H (1939) *Varicose Veins* St Louis, Mosby
Piersol, G A (1916) *Human Anatomy*, 5th ed Philadelphia, Lippincott
Sherman, R S (1944) "Varicose Veins Anatomic Findings and an Operating Procedure Based upon Them" *Ann Surg*, **120**, 772
— and Ogden, E (1946) "Physiologic Considerations in the Case of Patients with Varicose Veins" *Arch Surg, Chicago*, **52**, 402
Von Lanz, T, and Wachsmuth, W (1938) *Praktische Anatomie* Berlin, Springer

CHAPTER 4

THE VENOUS CIRCULATION OF THE LEG

THE PRIMARY and secondary functions of the veins of the leg may be stated as follows

(1) The conveyance of blood from the capillaries to the heart
(2) To act as a reservoir for the storage of blood to be used in emergency

Both arteries and veins are very similar in construction the former having more muscular tissue in their make up They both react to various stimuli amongst which are

(a) Nervous
(b) Mechanical
(c) Endocrinological
(d) Thermal
(e) Chemical

Nervous control of the vein keeps it in " tone Nervous stimulation may cause constriction of the vessel whether this stimulation be applied locally from a divided nerve or centrally from a centre in the medulla

Mechanical stimulation causing a constriction in the vein is well known to us all In giving an intravenous injection it is often difficult to get the needle into the vein for the second time owing to the contraction which has been caused in the first instance

The effect of *endocrines* on the tone of the vein has been appreciated since Sicard first pointed out the effect of puberty menopause and menstruation in many patients

Thermal stimuli are also well recognized heat causing a dilatation, and cold contraction of the vein lumen

Chemical stimuli may either cause a contraction or a dilatation As an example, adrenalin causes the former and procaine the latter

When the veins of the lower limbs are healthy the blood flows from the lower extremities towards the heart In man this is uphill work, since gravity has to be overcome this factor is an important one in the aetiology of varicose veins since varices do not occur in quadrupeds whereas some 10 per cent of the human race are sufferers The difficulties in this venous return flow can be well appreciated when one realizes that sometimes for many hours at a stretch the blood column has to travel towards the heart through a vertical channel some $1\frac{1}{4}$ metres in length Moreover however slender the lower extremities of the human may be, they are clumsy and plump compared with the hind legs of the average four legged animal Relatively they contain much more blood especially venous and the hydrostatic pressure is controlled by the tone of the vessels and by the support given by the muscles the strong fascia, and also in part by the skin

There is always a positive pressure in the leg veins in the erect position, and the driving force causing its return to the heart has been determined by innumerable physiological experiments

Venous pressures

Venous pressure mainly depends upon the hydrostatic pressure, and it will be found that venous pressure gradually diminishes as the limb is elevated The velocity of the flow of venous blood is inversely proportional to the back pressure occasioned by the long column of blood When lying down, the effect of gravity is ruled out and the intravenous pressure falls (Villaret, Saint-Girons and Salasc, 1925), but it is obvious that when the erect posture is adopted gravity plays a most important part in effecting the return of blood from the legs Krogh (1929), in an experiment, found that on raising the arm the venous pressure decreased regularly until a point about 10 centimetres below the level of the shoulder was reached On further raising the arm additional alteration in pressure did not occur This he explained as being due to an increase of the intravenous friction occasioned by the steady collapse of the veins on the limb being raised

Since capillaries are both permeable and dilatable, there is usually a tendency for blood to gravitate to the lowest parts, such as the legs For example, in healthy man it has been shown that half a litre of blood may be added to the legs after standing for one hour This addition will disappear if the subject either walks vigorously or elevates the limb (Atzler and Herbst, 1923)

Many authorities have shown that the venous pressure in the superficial veins of the leg is reduced by muscular action Furthermore, pressure of 90 mm Hg may be reduced to 20 mm Hg when the patient lies down These are very important points in the treatment of the gravitational factor Treatment depends so much on exercise and on elevation of the limb when possible The physiologists have given us reasons for this When varicose disease is present and the valves are incompetent the hydrostatic pressure will be transferred to the deep veins of the leg This increase in pressure will furthermore be transferred to the superficial system if the valves in the communicating veins are inefficient As a result very high readings of venous pressure may be obtained both in the superficial and deep veins under these circumstances

Factors causing the return of venous blood to the heart

(1) The muscle pump
(2) Muscle tone and involuntary contractions
(3) The arterio-venous shunt
(4) Capillary pressure
(5) Cardio-thoracic aspiration

The muscle pump

The main driving forces behind the ascent of the venous blood are derived from the pumping action of muscle on the veins themselves, directly on the deep and indirectly on the superficial veins This pumping action even occurs in human beings who are standing quite still, since a degree of muscular contraction is always present and these movements when aided by the mechanism of the venous valves are usually adequate in maintaining a venous flow This is the

most important factor and the one we have to consider when treating the indurated limb Both the patient and the physiotherapist have to concentrate on improving the muscular tone of the limb under treatment

Fig. 63 shows the mechanism of the calf muscle pump in diagrammatic form When the calf muscles contract they increase in bulk Expansion outwards is limited by the tough and inelastic fascial sheath thus causing forcible

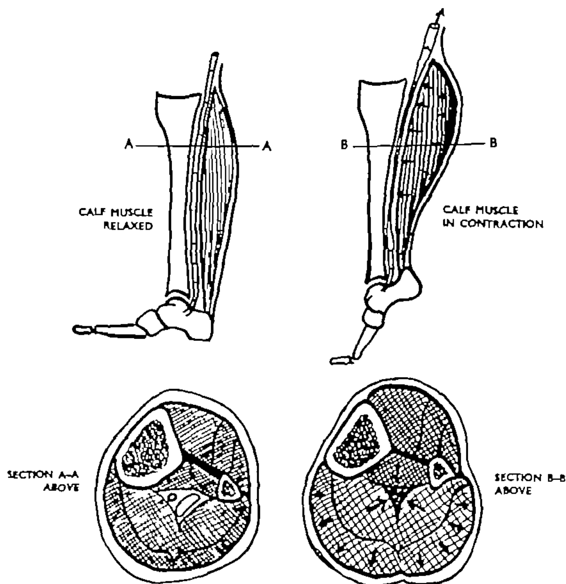


FIG 63 —Calf muscle pump

compression of the deep vein lying in the intermuscular space This contraction of muscles in conjunction with competent valves causes the blood to ascend the leg by the process of "relay pumping From the diagram it can also be seen that the site of highest back pressure in the deep vein is in the lower one third of the leg where the vein has least muscular support In cases of valvular incompetence therefore this is the point of greater strain and it explains why the various post thrombotic complications are invariably limited to this part of the leg.

Muscle tone and involuntary contractions

In the vertical static posture this involuntary venous compression from muscles is enough to keep the veins fairly empty, but even so allows a certain amount of stasis, as evidenced by the discomfort which soldiers standing at attention incur and which may also be observed in the leg-crossing movements of those who are committed to prolonged sitting. These points were well brought out by Hooker (1911). In addition, Henderson and his colleagues (1934) have called attention to the fact that an intrinsic muscular tonus may be of importance.

Arterio-venous shunts

Arterial blood may pass directly into the venous system without first passing through the intervening capillaries. This mechanism is known as an arterio-venous shunt. Those interested should read the original work of Piulachs and Vidal-Barraquer (1953), who suggest that not only may this mechanism be a factor in causing the ascent of the blood, but also an aetiological factor in the cause of varicose veins. I can find no writings to confirm their ideas since the date of the original article.

It has also been suggested by various authors that the compression from the pulsations of the adjacent arteries may be a secondary factor in hastening the ascent of the blood from the limb.

Capillary pressure

Another force which drives the blood forward results from the accumulation of blood in the veins which has come from the capillary bed. This has been referred to in the discussion on anatomy as a " venous sole " (*semelle veineuse*) and comes into play on walking. The normal capillary blood pressure is about 10 mm Hg, and this pressure is quite inadequate to return blood to the heart when a patient is standing. It is the help given by the normal valve and the continuous contraction, both tonic and voluntary, of the leg muscles which cause the blood to ascend towards the heart.

Cardio-thoracic aspiration

Although the speed of the venous flow is generally increased by the movements necessary for respiration, evidence has accumulated from experiment which tends to show that although inspiration definitely helps the bloodstream from the neck area and from the arms it impedes the flow from the legs. The lowering of the diaphragm increases the intra-abdominal pressure which directly raises the pressure in the inferior vena cava. Schwartz's test, in which the cough impulse is imparted down the saphenous vein, demonstrates this point. It is of interest to note that Jacobson (1866) found a constant negative pressure in the superior vena cava. He concluded from this finding that the peripheral veins were emptied by a process of aspiration. This negative pressure has been attributed to the aspirating action of the heart (Glenn, 1877) and also to the dilatation of the great veins in the thorax resulting from inspiration. In the human, quiet breathing has little effect on the venous pressure in the leg, but deep inspiration lowers the pressure (Seiro, 1937, Hooker, 1911, Fuchs, 1921, Bedford and Wright, 1924). To show the complications of this object, however, both Magnus (1921) and Ledderhose (1906) have found that there is an increased saphenous pressure on deep breathing.

The reservoir function

It has been computed that a third of the volume of the blood in the body is to be found in the lower limbs This blood is available for the body and leaves its reservoir in answer to various stimuli which have already been discussed in this chapter For this reason the amount of blood in the lower limbs is variable according to which particular stimulus is acting

In the varicose limb this depot function of the veins is lost, since although just as much and perhaps more blood is being stored in the dilated varicose veins this blood is in part stagnant owing to the diseased veins failure to react to many of the stimuli The blood in the dilated varices forming stagnant pools is greater in volume than that to be found in the healthy limb This may well account for the aching and cramp experienced by the sufferer from varicose veins Support to the limb by means of elastic stockings or bandages relieves these symptoms by causing a more rapid venous return and by tending to empty some of these dilated venous sinuses

Incompetent valves in the communicating veins of the thigh may cause a localized venous circulation since the blood ascending in the limb may thus be short-circuited before it gets to the saphenous opening. In this way a certain amount of blood may remain in the leg veins for a considerable period of time This blood will be kept starved of oxygen and the findings of de Takàts and his colleagues (1929) who showed that the carbon dioxide content of blood in varicose veins was increased and that the amount of oxygen was lowered is evidence in favour of this localized circulation This large quantity of deoxygenated blood in the lower limbs may well be a factor in the patient s health So often one finds after rendering limbs healthy that the patient volunteers the statement that she feels so much better in herself This of course may be psychological or may be due to the improved limbs but I have a feeling that the decrease in deoxygenated blood may well be a factor In passing, it is interesting to note that the entire removal of the superficial saphenous systems is relatively unimportant to the venous return of the lower limb a point which is made obvious after the complete stripping of the superficial system

These anatomical and physiological relationships which have been described quite briefly will be further considered when the aetiology and pathology of varices are under review

The study of the physiology of venous return in the lower limbs has helped us to understand in so many ways the treatments we give Not only has it shown us the advantages of compression treatment but it has also helped us to instruct our patients regarding the " new way of life they must follow after their ulcers have been healed In other words their new habits have to combat the gravitational factor Remember that exercise reduces venous pressure and that elevation of the limb has the same effect.

At this stage a few words on *oedema* may help to clarify the ensuing chapters

Oedema

The term oedema denotes swelling due to an increased quantity of tissue fluid in the interstitial spaces This tissue fluid is not a static pool but is constantly flowing and nourishing the cells which it bathes

A brief survey of the factors which regulate the normal flow of tissue fluid will help towards the better understanding of the pathological causes of oedema

At the *arterial* end of the capillary, the blood pressure (32 mm Hg) exceeds the osmotic pressure exerted by the plasma proteins (25 mm Hg), and fluid therefore passes out into the tissue spaces At the *venous* end, the blood pressure (10 mm Hg) is lower than the osmotic pressure of the proteins, and some of this fluid is therefore reabsorbed into the bloodstream The remainder passes into the thin-walled lymphatic vessels, and is then carried through the lymph glands and main lymphatic trunks before being returned to the bloodstream near the heart Normally the production and removal of tissue fluids is a finely balanced process, and there is no accumulation or oedema

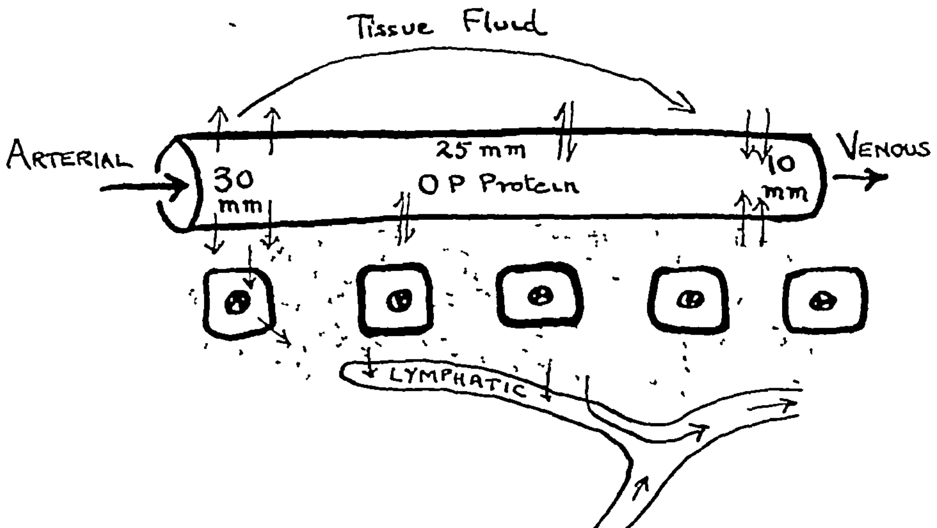


FIG 64 —Diagram showing the mechanism of fluid interchange between capillary, tissue space and lymphatics (*After Samson Wright*)

The amount of tissue fluid produced is fairly constant, and therefore oedema is generally caused by *abnormalities of reabsorption*

The most common cause is *increased venous pressure*, which competes against the osmotic pressure exerted by the plasma proteins Increased pressure in the veins may be due to *congestive heart failure*, *obstruction of the vein* by thrombus or outside pressure, or the effect of *gravity* in the presence of *valvular incompetence*

A *fall of the plasma protein* concentration is responsible for deficient reabsorption and occurs in severe *malnutrition* or *chronic renal disease*

Lymphatic obstruction due to *fibrosis* or *malignant invasion* of the lymph channels causes an increase in the amount of tissue fluid, and eventually leads to the characteristic condition of *lymphoedema* (*see* Chapter 18)

Increased permeability of the capillary wall is probably not of great importance in the production of oedema, except in purely local inflammatory conditions

Chronic postural oedema

This type of oedema is described by some writers, such as Irving Wright (1952), as "dependancy oedema" and was also described as "shelter foot" by Knight (1940) Although this condition is by no means uncommon it has received comparatively little attention Those who undertake prolonged journeys in the

sitting position are apt to develop oedema if they take no walking exercise during the journey Wright calls our attention to the acute form which may develop in pole sitters He quotes one case where large blisters dripping fluid developed on the feet of one of these peculiar people. It is suggested further that the cause of this oedema is mainly due to a venous obstruction, and Wright suggests that the following positions are the most likely

(1) The popliteal space where the knee folds.

(2) The posterior surface of the thigh where pressure from sitting interferes with the venous and lymph return flow

(3) The fold of the groin where obesity and tight underwear may cause enough pressure to impede the return flow

Patients who develop this condition usually get well quite quickly with elevation of the limbs and exercise Cases are on record however where fatal emboli have followed oedema resulting from very prolonged journeys From a practical point of view patients should be advised that, when travelling long distances either by train, car or aeroplane, leg movements and exercises are an advantage during the journey Again women should be told about the advantage of removing tight girdles and other clothing which may press on the points already mentioned.

Slight transient oedema may occur in elderly patients who have been confined to bed for a period of time In the few weeks following the restoration of their bodies to the vertical position transient pitting of the ankles may occur without any serious import.

BIBLIOGRAPHY AND REFERENCES

Atzler E. and Herbst, R. (1923) *Z ges exp Med* 38, 137

Bedford, D E. and Wright, S (1924) "Observations on the Venous Pressure in Normal Individuals." *Lancet*, 2, 106.

Fuchs, L. (1921) "Über die Messung des Venendrucker und ihre klinische Bedeutung." *Arch klin. Med* 135 68.

Glenn, W F (1877) *Med. Brief* 5 193

Henderson, Y Oughterson, A W., Greenberg, L. A., and Searle, C. P (1934) "The Third Major Mechanical Factor in the Circulation of the Blood." *Science* 79 508

Hooker D R. (1911) "The Effect of Exercise upon the Venous Blood Pressure" *Amer J Physiol.*, 28 235

Jacobson, H (1866) "Über die Blutbewegung in der Venen." *Arch path Anat.*, 36 80

Krogh, A (1929) *Anatomy and Physiology of Capillaries*, 3rd ed. New Haven, Conn. Yale University Press.

Lerlderhose, G (1906) "Studien über den Bluthauf in der Hautrenen unter physiologischen und pathologische Bedingungen." *Mitt Grenzgeb Med Chir.*, 15 355

Magnus, G (1921) "Lolkulationsverhaltnisse in Varicen." *Dtsch. Z Chir* 162, 71

Prulachs, P., and Vidal Barraquer F (1953) Pathogenic Study of Varicose Veins" *Angiology* 4 59

Seiro V (1937) "Über Blutdruck und Blutkreislauf in der Krampfaden der unteren Extremitaten." *Acta chir scand* 80 41

de Takàts, G Quint, H., Tillotson, B I., and Crittenden, P J (1929) "The Impairment of Circulation in the Varicose Extremity" *Arch Surg Chicago* 18 671

Villaret, M., Saint-Girons, F and Salasc, L. (1925) "La Tension Veineuse périphérique dans les varices des Membres Inférieurs." *Ann. Med.*, 18, 87

Wright S (1939) *Applied Physiology* 7th ed. London Oxford Medical Publications.

CHAPTER 5

THE PATHOLOGY OF THE VARICOSE VEIN

THE MORBID anatomy of the fully developed varicose vein has been well understood for a long time The intermediate stages, however, which lead up to the formation of the diseased vein, in other words the pathogenesis of the condition, are still a matter of controversy Established or gerontic varices may present all or the majority of the following conditions (1) Elongation, (2) tortuosity, (3) impairment or absence of elasticity; (4) localized dilatations, (5) variations in the thickness of the vein wall, (6) valvular atrophy, (7) localized patches of thrombosis, and (8) areas of calcification



FIG 65 —Section of a varicose vein The vessel is grossly dilated and the wall is thinned out There is a thickening of *the intima, while the media* and adventitia are hardly discernible A small artery almost obliterated by intima fibrosis is also visible in the picture

The internal saphenous vein is more frequently affected with varicose disease than any other vein in the body Delbet and Mocquot (1913) stated that 98 per cent of varicosities are to be found in this vein This is not so, however, since the external saphenous vein is now known to be involved in a very large percentage of cases of varicosity of the lower limb This vein so frequently forms a part of the internal saphenous system when the communicating veins between the two systems are involved From the practical point of view we find it increasingly necessary to strip both systems at the same operation The author has noted that the external saphenous vein is more frequently involved in the male than in the female No previous reference to this has been noted and the reason for this fact has not been discovered

Elongation and tortuosity and localized dilatation

The tortuosity of the varix is caused by elongation of the vein Dilatations may be considerable and may cause the venous lumen to become several times the normal size These localized swellings of the veins may be either saccular or

fusiform in type, and when occurring at the sapheno-femoral junction may be big enough to resemble a large femoral hernia.

Impairment or absence of elasticity

The loss of elasticity in the varix is due to the abnormal increase in the connective tissue. The variations in the thickness of the vein wall depend on the hypertrophy and atrophy of the tunica media. The atrophic process may become sufficiently advanced to make the vein walls so thin that they may burst. This atrophic process may affect the overlying skin and in this way a severe haemorrhage may be occasioned from the rupture of an atrophic varix.

Thickening of the vein wall

Veins which are thickened by the hypertrophic process show microscopically a marked hypertrophy of the tunica media. This thickening is associated with an increase in the muscle fibres but it should be noted that the increase in intramuscular connective tissue may be slight or absent.

Valvular atrophy

Atrophy of the valves is an important pathological factor in the varix which may result in partial obliteration of the valve cusps or in their destruction. Klotz (1887) notes that this condition also occurs sometimes in the senile patient even in the absence of true varicosities. Further reference to the question of valvular atrophy will be found under the discussion on pathogenesis (*see* Chapter 1) where it will be observed that authorities vary in their opinions as to whether valvular atrophy occurs before or after the development of varices.

Thrombosis and calcification

Spontaneous clottings may occur but these are associated with inflammatory changes in the vein wall. Calcification sometimes occurs in a thrombus and many years after an attack of thrombophlebitis small, hard, chalky nodules may be felt in the length of the vein. These are the late or secondary changes to be found in the examination of a varicose vein. It is to be hoped that we shall one day have more information regarding the early pathological changes in the primary varix and that less emphasis will be laid on the late secondary changes as described above. In the chapter on aetiology will be found a discussion on the early histological changes as described by Professor King of Melbourne University. These early changes which he attributes to *primary* varicose factors probably of hormonal origin are of great pathological interest. They may well point the way towards a far better understanding of the cause of varices.

REFERENCES

Delbet, P., and Mocquot, P. (1913). "Varices du membre inférieur." *Ann. Clin. chir. Delbet* 2, 1

Heller, R. E. (1940). "The Pathological Physiology of Varicose Veins." *Surg. Gynec. Obstet.* 71, 566.

Klotz, K. (1887). "Untersuchungen über die Vena saphena magna beim Menschen besonders rücksichtlich ihrer Klappenverhältnisse." *Arch. Anat. Physiol., Lpz.*, p. 159

CHAPTER 6

INVESTIGATION OF THE PATIENT

THE TREATMENT of varicose veins is based not only on the careful evaluation of the condition of the diseased limb, but also depends upon the health, work and longevity of the patient The majority of patients present not only an individual but a varied problem For those of us who treat varices to the exclusion of all other subjects this variety is welcome and makes the study of the varix one of absorbing interest

THE HISTORY

In the investigation of the patient careful history taking is essential This should be followed by a general examination prior to an assessment of the local condition It will be found in this chapter that under the local examination many tests are described Few if any of these will be found to be necessary once adequate experience is gained by the examination of the thousands of patients who throng into our clinics

Various types of form are used for noting the history and examination results That shown on the next page is found to be useful, since it allows a rapid enumeration of the salient points

A diagram of the limb is an additional help for noting the position of the varices and ulcers more accurately Were it possible to obtain small photographs of all our patients before and after treatment for attachment to the examination form, more accurate records could be kept and the information provided by such photography would prove to be invaluable when assessing the results of treatment in later years

The history given to us is of the greatest importance and should be directed firstly towards the general condition of the patient and, secondly, towards the local condition of his limbs

Age and longevity

Having ascertained the patient's age, his probable expectation of life should be assessed by enquiry regarding the ages attained by near relatives Other things being equal, age need not be taken into account when considering operative treatment in those who are likely to live for some time Conversely some younger patients may be found to have a relatively short expectation of life and for this reason may be better treated by conservative measures.

Occupation

Details of the patient's work are all important when planning treatment Enquiry should be made as to whether his work entails prolonged standing and as to whether any alternative form of occupation of a more sedentary nature is possible Our advice and treatment may have to be varied according to the type of work the patient is following For example, advice may be quite different for the policeman as opposed to the sedentary civil servant Supportive measures

may be all that are necessary for the latter whereas more active treatment will be required for the former Operative treatment should not be tendered to all and sundry without consideration as to whether the occupation of the patient necessitates active measures When enquiring about the patient's work it is as well to consider his habits generally Does he play vigorous games, or follow any pursuit which submits the veins of the lower extremities to excessive strain?

General health

The general health of the patient should be assessed and he should be asked whether he has suffered from any serious illnesses during his life Particular reference should be made to rheumatic fever which might well have produced

HOSPITAL

VARICOSE VEINS CLINIC

MR.

CASE No.

REGISTER No.

DATE OF EXAMINATION

PATIENT'S NAME

AGE M.S.W.

PATIENT'S ADDRESS

OCCUPATION | PATIENT'S OWN DOCTOR | DIAGNOSIS

	RIGHT	LEFT	COMMENTS
VEINS			
OEDEMA			
ECZEMA			
ULCER AREA			
PHLEBITIS			
FEMORAL THROMBOSIS			

DATE	PROGRESS NOTES

FIG 66

cardiac oedema. Specific fevers such as typhoid and pneumonia are also of importance as far as deep vein thrombosis is concerned. The question of anaemia is an important one, since many patients suffer from prolonged ulceration through inattention to this point. In all patients who have suffered from varicose ulceration for any length of time it is wise to check the state of the blood

When enquiring about the general health it is also as well to assess his mentality It will be seen later that patients with a low grade mentality are unable to manipulate the various types of elastic bandages which we recommend Furthermore, they are unlikely to carry out the exercises and elevation of the limbs which are so essential in some conditions Alternative methods of treatment will be found necessary with this type of patient Again, it is of no use trying to heal an ulcer if its presence represents some financial gain to the patient Recently it was not found possible to heal the ulcer of a matchbox seller, until it was discovered that the ulcer was a most important factor in her economic life Again, failure to heal an ulcer may bring to light the fact that the patient is a pensioner whose claims have been reviewed with sympathy by the Ministry We must realize that every case of varicose veins may be a sick patient, whose varices form quite a minor part of the troubles associated with his general health and life There will be far fewer recurrences and criticisms of the treatment of varicose veins if the examiner takes every care regarding the general history of the patient As an example of a common failure in careful history taking, secondary recurrences of oedema after operation are sometimes traced to nephritic or cardiac troubles which were not investigated at the first examination Again, a failure to test the Wassermann reaction in suspicious cases may be disastrous



FIG 67—Obesity associated with varices Note the large connecting vein between the internal and external saphenous veins This type of patient who has neglected her body is unsuitable for operation A pendulous abdomen, often associated with tinea in the groin, makes the operative field one of danger Also pulmonary embolism following deep vein thrombosis is more common after operations on the obese On the general principle that no risk is justifiable in the treatment of varices, the patient is better treated by means of supportive bandages until her weight is reduced to a reasonable level

Questions devoted to the local condition of the patient

Symptoms

The enquiry as to how long the patient has suffered from varicose veins is helpful and at this time the patient should be asked whether the veins have altered in any way over the years. It may well be found on enquiry that there has been no change in their state for many years and that they have given rise to no troubles or complications As will be seen later this type of patient may frequently be helped by means of supportive treatment only since there is really no indication



FIG. 68 —Collateral circulation. Patients presenting this picture should be examined carefully in order to exclude the presence of a pelvic tumour The commonest cause of this condition is a past attack of ilio-femoral thrombosis.

for treatment except on cosmetic grounds. He should then be asked from what symptoms he suffers. Do the legs ache or swell, and has there ever been an ulcer or eczema at any time? Pain is not a commonly associated condition with most varicose limbs and in its presence other factors must be sought for such as an arthritic joint or sciatica The patient must understand prior to operation that relief of such pain cannot be expected *Severe cramp* however is quite a common symptom of varices and this can be expected to disappear after the thorough treatment of the causal condition In passing it is of interest to note that small doses of quinine are sometimes helpful and that the antihistaminic Benadryl gives relief in a certain number of cases Resistant cases of cramp will sometimes react well to the vasodilator drugs and I have found Cyclospasmol (Camden Chemical Co) to be one of the most successful of these

As prophylactic treatment, fatigue and chilling of the limbs must be avoided During an attack, massage and warmth are of help The removal of varicose veins will cure quite a large proportion of patients whose main troubles have been nocturnal cramps, but I have also noted that the highly nervous type of patient



FIG 69 —The enlarged legs of a young patient with hypopituitary disorder Slight varices are present in the left thigh This photograph is shown to remind the examiner to be on the look-out for general diseases This patient thought her varices to be the cause of her enlarged legs



FIG 70 —A case of extensive varicose disease Note the varicose condition of the superficial epigastric and circumflex iliac veins

seems to be more liable to cramps than others The muscles of such patients may be *in a state* of hypertonus for a lengthy period They are best treated by means of a sedative in conjunction with an antihistaminic A good example is Protamyl (May & Baker) which is a barbiturate in combination with Phenergan

Summarizing, the main points to ask regarding the patient's legs are Do they ache swell or suffer from cramp? Questions regarding general health, occupation and family longevity must also be included

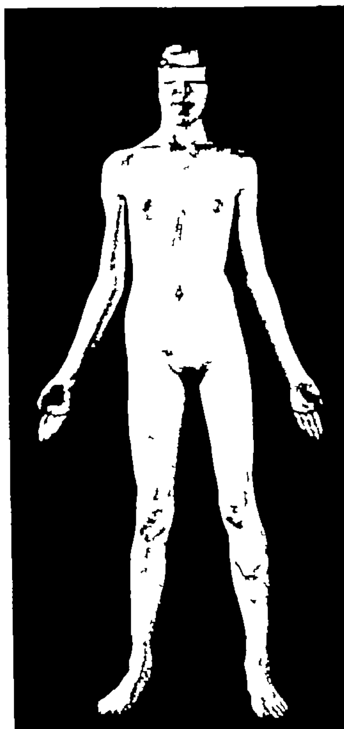


FIG 71.—A child of 14 years with varices over the left tibia. At the time of examination it was appreciated that the tibia was enlarged and showed a raised temperature. A murmur was to be heard over the swelling and further investigations demonstrated an aneurysm associated with bone. This picture is shown in order to demonstrate varices in a young child and in order to impress the examiner with the need for a careful examination of all cases presenting themselves in a varicose vein clinic.

Venous insufficiency

The question as to whether a " white leg " has occurred after either operation, childbirth or other causation should be raised This history is sometimes difficult to elucidate, but as a rule, prolonged convalescence after childbirth or operation is a pointer in this direction When enquiring about this condition it is as well also to find out whether there have been any attacks of superficial phlebitis in the past As a rule, it is necessary to ask whether there have been any patches of red inflammation in the course of the veins associated with discomfort and temperature, since the patient is otherwise apt to confuse superficial phlebitis with the signs of deep vein thrombosis

Past treatment

The question as to past treatment is of importance and details of previous surgical interference should be obtained We may be told whether the ulcers have reacted to pressure treatment, and whether the patient is allergic to elastic adhesive bandages or not

In a busy clinic history taking does not occupy much time, since the various points discussed in the last few pages are speedily elicited by the trained examiner However, it is once again emphasized that no detail in the history, however small, should be ignored

GENERAL EXAMINATION

Whenever possible a complete physical examination must be made *Examination of the abdomen must never be omitted* General diseases, infectious complaints, peripheral arterial disease and pelvic tumours may all have a considerable bearing on treatment (Figs 68–71) As will be found in the chapter on the therapy of varices, myocardial and renal diseases are a contra-indication to active treatment, and diseases such as diabetes mellitus, hyperthyroidism and severe anaemia are contra-indications to active treatment until such time as these general diseases are cured or controlled

LOCAL EXAMINATION

The patient should be standing on a platform in a good light with the extremities completely exposed from the groin to the toes (Fig 72) The examination should be made starting in the groin, noting the presence or absence of enlargement of the *internal saphenous* vein and whether any tributaries are present in the lower abdomen and pubic region A considerable enlargement of the internal saphenous vein should be marked on the case sheet with " four plus ", " three, two and one plus " denote lesser degrees of enlargement The fingers should be used to feel the veins, because varices can always be felt before they can be seen This fact was readily appreciated by those dealing with Arabic medicine, since the word *al safin* means " hidden " or " secret ", and was the term used for the saphenous vein in those days Arabic medicine concerned itself with blood-letting only and realized that the saphenous in health is hardly visible In passing, it is of interest to note that Vesalius (1514–1565) referred to the saphenous as the *vena matricis*, since he employed it for venesection in cases of uterine trouble The internal saphenous vein should be palpated down to the toes with the finger-tips and the presence of oedema eczema or ulceration recorded on the chart The main trunks of both

the internal and external saphenous veins are relatively straight in the most varicose of limbs The obvious tortuous and much enlarged varices are usually tributaries This is just as well since in the operation of stripping, the passage of the stripper is much more easily performed than one would suppose at the time of examination



FIG 72.—The position of the patient during examination. The surgeon sits on a low stool facing the limbs which are fully exposed. A couch behind the patient allows her to sit or lie for the injection if required. The pole gives the patient a feeling of security and minimizes acrophobia

When the patient is standing with his back to the examiner the condition of the *external saphenous* vein should be noted and its degree of enlargement tabulated by the same method as that used for the internal saphenous vein It is not possible to examine the external saphenous vein unless the knee is flexed The dilated termination of the vein is obvious under these conditions If the knee is rigid, however the strong fascial covering of the vein is tensed and the vein becomes flat

and impalpable (Fig 73) A note should be made of the size of *ulcers* if present and a rough drawing of their delineation may be made with advantage When noting the *oedema* it should also be observed whether it is the soft oedema associated with venous insufficiency or whether it is the hard, brawny oedema more commonly found in cases of lymphatic obstruction The clefts between the toes should always be examined in order to exclude *tinea interdigitalis* since the presence of this condition may indicate that the ulcers or eczema present are of tineal origin Particular note is made of the position in the lower limb of *eczema* and of ulceration and whether this falls inside or outside the area which is attacked by varicose vein conditions (Fig 222) Any ulcer above the upper third of the inner side of the leg is non-varicose This applies also to those occurring on the upper two-thirds of the outer side of the limb Other complications of varices such as muscular atrophy and flat feet must be looked for and noted Swollen joints must be examined, since after operation rheumatic pain may persist and the patient will be disappointed if this is not explained before the veins are treated By observation and palpation the examiner can satisfy himself as to the best treatment for his patient Many complicated tests have been evolved for the testing of the condition both of the deep and superficial venous systems and for the determination of the state of the communicating veins Few of these tests are used by the author, but they will be described in the text for the benefit of those who are interested

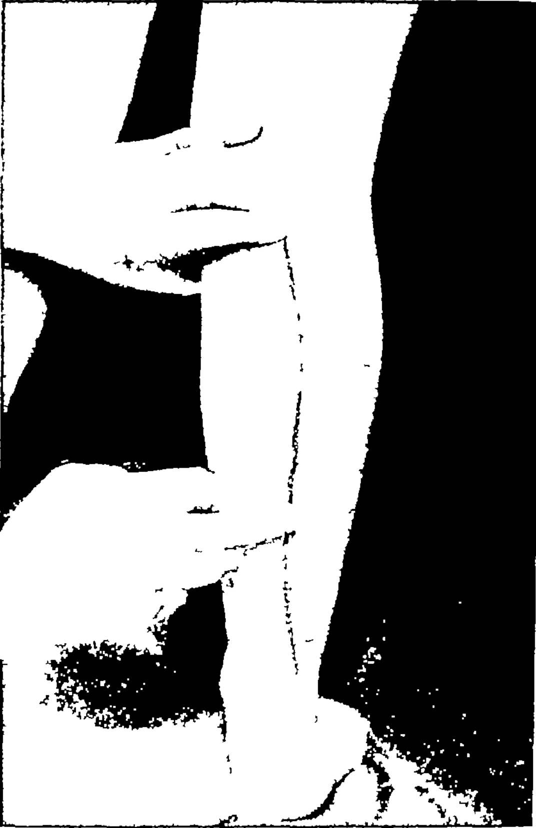


FIG 73 —Myers's percussion test Determining the course of the external saphenous vein , note that the knee should be slightly bent to make the upper end of the vein more easily palpable

Garber and Rand (1948) state that they agree with Homan's advice that a *normal colour of a foot indicates a satisfactory deep circulation of the leg* These writers derive very little help from the complicated tests which have been described in the past and state that, regardless of the result of the Trendelenburg test, treatment of a varicose internal saphenous vein should be the complete elimination of the vessel

Summarizing the local examination of the patient

(1) Look at the colour and shape of the limb

(2) Feel *lightly*, with the tips of the fingers the course of both the internal and external saphenous veins

(3) Feel for the blow-outs the faulty communicating veins in their usual positions (*see* Fig 49)

(4) Note oedema the condition of the skin and the presence of ulceration or eczema

(5) Make certain the joints have full movement

(6) Note the presence or absence of flat foot and faulty muscle development

(7) Look for tineal infection between the toes or in the groin

(8) Check the arterial condition of the limb (*see* page 89)

The above elementary and practical examination will tell you all that is necessary with the average patient. Experience can only be gained by the examination of large numbers of patients in the clinics but surgeons who deal largely with varicose troubles scarcely ever need the complicated tests recommended to them as students In a recent book on varicose veins sixty-seven pages are given up to the diagnosis of varicose veins I claim that this merely makes the subject more difficult than it should be and that most of the advice given is of academic interest only However for those who may be interested I shall describe very briefly some of the tests which may at least be of importance to the student in helping towards an understanding of the varicose circulation

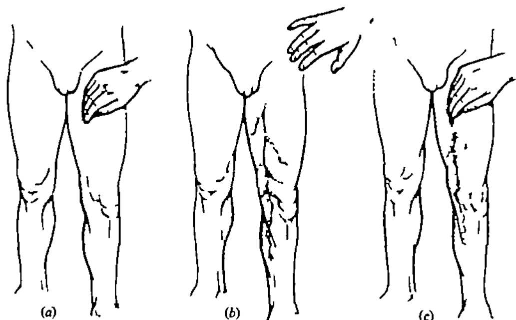
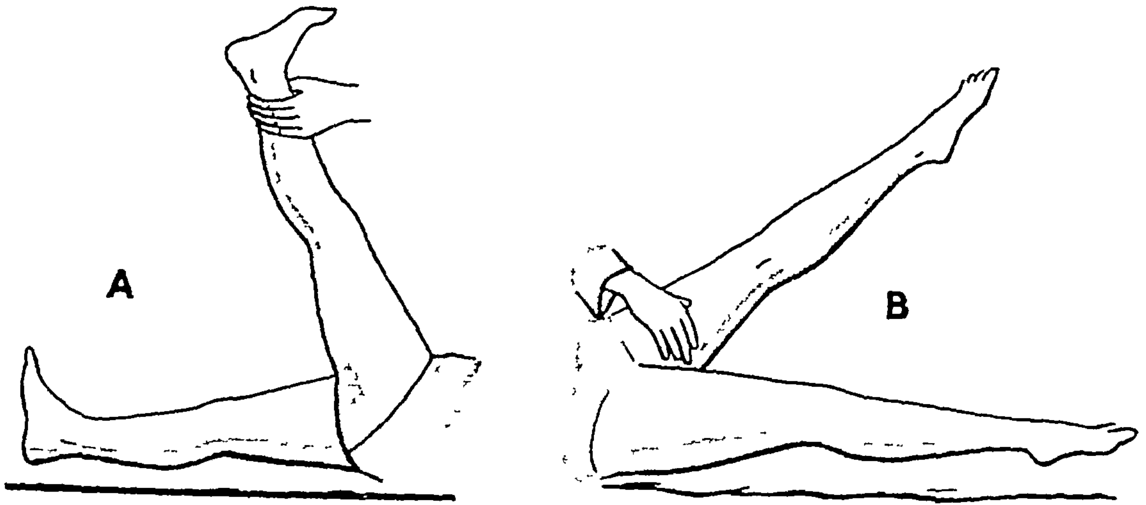
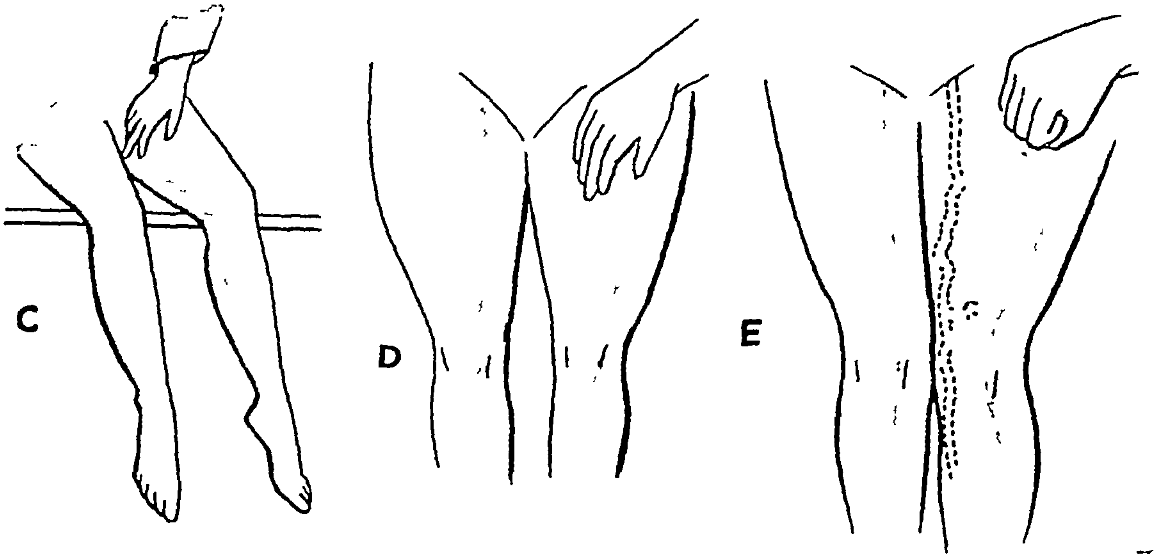


Fig 74 —Trendelenburg test (*a*) the internal saphenous vein is emptied of blood by an upward sweep of the examiner's hand which then exerts pressure over the foramen ovale (*b*) pressure released rapid filling proves incompetence of valves of internal saphenous vein (*c*) filling while pressure is maintained shows incompetence of com municating veins.

Clinical tests

Tests have been evolved in order to determine (1) The competence of the valves of the internal or external saphenous veins (2) the competence of the valves of the communicating veins (3) the patency of the deep venous system.





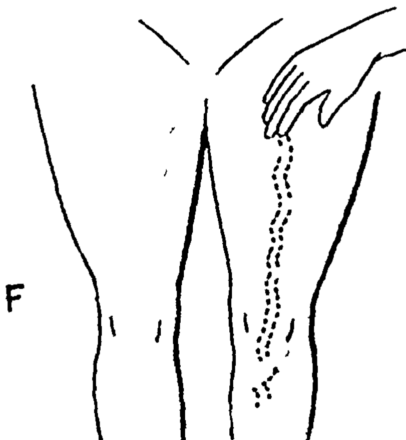


FIG 75.—The Trendelenburg test—alternative method (A) the patient is recumbent and the veins are emptied by raising the limb, (B) pressure is applied over the termination of the internal saphenous vein, (C) the patient sits while the pressure is maintained, (D) pressure is kept up with the patient standing, (E) the digital pressure is released, rapid filling of the vein from above indicating valve incompetency, (F) the test is repeated, with the difference that the pressure is not removed from the region of the foramen ovale for at least 30 seconds Filling of the veins during this time suggests an incompetency of the communicating veins connecting the deep and superficial systems Such combined findings are referred to as a " doubly positive reaction "

These tests may be enumerated (a) The Brodie Trendelenburg test (b) the Perthès's test (c) the Ochsner Mahorner test (d) the differential tourniquet test (e) the double tourniquet test (f) the elastic bandage test (g) the percussion test and (h) tests for incompetent communicating veins

The Brodie-Trendelenburg test

It will be seen that this test (Figs 74 and 75) is a method for the determination of the competence of the valves of the internal saphenous vein as well as an approximate guide to the condition of the communicating veins The test is not sufficiently localizing in practice, but it is useful if the venous valves are proved to be competent, since surgical intervention is then contra indicated Two methods of performing this test are illustrated and their legends are self-explanatory

Perthès's test

This test will serve to demonstrate the patency of the deep veins at the level at which the tourniquet constricts the superficial venous system. A tourniquet is applied to the middle of the thigh (Fig. 76) As the patient walks the veins become more prominent, showing that there is some obstruction to the deep system. An improvement in the condition of the varices after exercise will demonstrate the converse, showing that the communicating veins between the two systems are functioning and that the blood is able to return *via* the deep system, which is not thrombosed

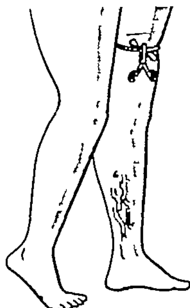


FIG 76—Perthès's test

The Ochsner Mahorner test

This test is probably the most valuable, since it gives information regarding the condition of the deep veins, communicating veins and internal saphenous vein at various levels The patient's varices are inspected under five conditions (a) standing (b) walking with no tourniquet (c) tourniquet applied at the upper third of the thigh whilst walking (d) tourniquet applied around the middle third of the thigh whilst walking (e) tourniquet applied around the lower third of the thigh whilst walking. The condition of the varices *below* the tourniquet is all that has to be considered *When the tourniquet is below the lowest communicating vein in which the valves are incompetent the distension of the veins becomes less when the patient moves about* The originators of this test divide their findings into various grades Grade 4 improvement is a term they use when the vein disappears entirely on exertion, whereas Grade 1 improvement implies there is only slight improvement. The changes are recorded for each of the various levels at which the tourniquet has been applied. The diagram (Fig. 77) and legend will serve to elucidate this point and have been copied from Ochsner's instructions. Those surgeons who perform multiple ligations find this test of value The originators claim that only 2 per cent of cases will be shown to require ligation below the knee level. The stripping technique which we now use makes these tests have but little significance.

The examination of the pulses

This is an important test of arterial sufficiency It should be noted that tl dorsalis pedis artery is not only frequently displaced, but may be entirely absei in 14 per cent of normal cases. Again, the peroneal artery replaces the posteri(tibial vessels in 5 per cent of cases (Kramer, 1940) The popliteal artery shou! be palpated whilst the patient is lying down with the knee flexed Telford h: pointed out that in thrombo-angiitis obliterans it is not unusual to feel a firm ma: in the popliteal fossa, this fibrous thickening being due to the associated per arteritis



FIG 79 —An oscillometer (von Recklinghausen type) This instrument is of great value in testing the arterial efficiency of the lower limb Usually the maximum movement of the needle constitutes the " oscillometric index " An accurate measurement of the blood pressure may also be obtained by the use of this instrument

The oscillometer test

The oscillometer is invaluable in checking the arterial pulsations both quantitatively and qualitatively and allows a comparison of the two limbs At the same time an accurate reading of both the systolic and the diastolic pressures can be made The blood pressure of the leg is always higher than that found in the arm The information supplied also acts as a check regarding the progress of arterial blockage

The Samuel test

By the Samuel test thrombo-angiitis obliterans (Buerger's disease) and other causes of arterial obstruction may be detected With the patient in the recumbent position both legs are elevated to an angle of 90 degrees The patient should then rapidly flex and extend both feet If the plantar surface of the feet fades

from a normal pink to a marked cadaveric pallor the arteries are occluded This *plantar ischaemia is sometimes* referred to as *Goldslamm s sign* If after making this test the patient is asked to hang the leg over the side of the couch it will in the presence of a deficient arterial circulation take on a dusky blue red colour This discoloration is frequently referred to as rubor and is only seen in those who are suffering from arterial disease of an advanced nature By palpating the pulsation of the arteries in the foot and leg, this may be further checked

VENOGRAPHY

Venography

This method of investigation has been of the greatest importance in elucidating the pathology and effects of deep venous thrombosis Much credit is due to all the painstaking research work which has been done in this field However the value of venography in the day to-day management of venous conditions is severely limited It is our view that radiology is unlikely to yield any further information than can be obtained from a careful clinical examination Indeed the notoriously difficult and often conflicting interpretations of the radiographs obtained by the different methods serve only to confuse the issue



FIG 80 —Phlebogram demonstrating incompetence of the valves of the internal saphenous vein.

For the reader who is interested however a brief description of the technique of ascending venography is given. Further information may be obtained from the excellent original papers of Begg, Boyd Cockett and Muir

Technique of ascending venography

This is the most satisfactory method of venography in use today and the one least likely to give confusing pictures

The patient lies on the X ray table with the legs tilted *down* at least 10 degrees. A soft tourniquet is placed around the lower leg 2–3 inches above the malleoli to occlude the superficial veins. A small superficial vein on the dorsum of the foot is selected and 20 c.c. of 35 per cent Diodone is injected over about 20 seconds. (Occasionally it may be necessary to " cut down " on the vein, or inject direct into the marrow of the fibular malleolus, as described by Begg (1954)) The X ray plate under the leg is exposed at 20 seconds and a further plate under the knee and thigh at 30 seconds with the patient performing a forcible Valsalva manoeuvre (*see* page 92)

If it is especially required to demonstrate incompetent communicating veins in the lower leg, it is necessary to have the patient almost erect, and to expose the films at about 30–45 seconds after the injection is begun

Immediately after the films have been exposed, it is advisable to make the patient elevate the limb and exercise it in order to wash out any remaining Diodone from the veins, where it might otherwise remain as an irritant



Fig 81 —Normal lateral phlebogram with valves well demonstrated by the Valsalva manoeuvre (Catchpole)

The Valsalva manoeuvre

This most useful adjunct to venography has been carefully described by Catchpole (1953) and is of the greatest value in demonstrating the condition of the valves of the deep veins of the leg Essentially, it consists in asking the patient

to make a forcible expiration against a closed glottis This causes the intra abdominal tension to be raised and reverses the femoral vein flow thereby closing the valves and forcing the radio-opaque fluid back against them If the valves are incompetent the manoeuvre slows the flow of Diodone sufficiently to show a clear outline of the vein and may demonstrate incompetent communicating veins



(a) (b)

FIG 82.—Phlebograms (a) Showing varices of the internal saphenous vein in conjunction with thrombosis of the deep veins (b) Showing varices of the lower leg and demonstrating incompetent communicating veins.

Occasionally a patient is hypersensitive to iodine and may develop a reaction to the injection of Diodone It is wise therefore to perform a sensitivity test by injecting a small pilot dose (0·5 c.c.) and waiting 5-10 minutes before proceeding with the main injection

As with any intravenous injection a *loaded* syringe containing 1 1000 Adrenalin should be immediately available Should any anaphylactic reaction occur this solution should be given *at once* in doses of 5–10 minims *subcutaneously*

The measurement of venous pressures

The measurement of venous pressures in the leg at rest and while exercising, as described by Walker and Longland (1950), was a fundamental piece of research work of the highest significance, but it has no place as a routine diagnostic manoeuvre



FIG 83—A venogram demonstrating superficial varices This picture of a special method of venography is by courtesy of R Leman, F S R, of the Royal Victoria Hospital, Belfast

TYPES OF VARICOSE VEINS

Adhering to the ancient dictum that a picture is worth a thousand words the commonest varieties of varicose veins are shown in atlas form on the succeeding pages It is felt that the reader will be able to grasp the distinction between the different varieties more easily by studying photographs of actual cases than by reading through pages of text The treatment of the various types is discussed more fully in the next chapter

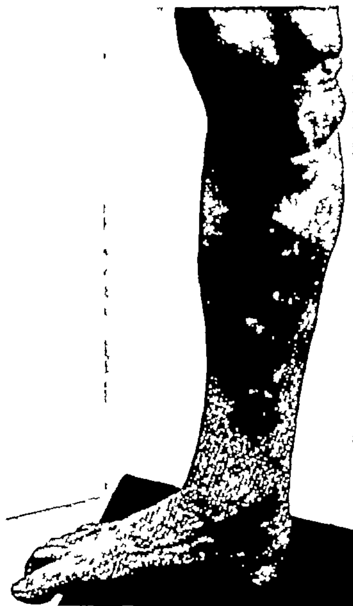


FIG 84—The *massive* type of varix, showing extensive tortuous convolution associated with severe varicose disease and incompetence of the valves of the internal saphenous veins. The saccular "blow-outs below the knee occur at sites of entry of incompetent perforating veins which are in direct communication with the deep veins A careful stripping operation deals with this variety in a most satisfactory manner



FIG 85 —The *intracutaneous* varix These veins are very thin walled and have poor skin covering They therefore have a deep blue colour and are often subject to rupture as a result of very minor injury A careful stripping operation of the main saphenous trunk, followed if necessary by sclerosant therapy, is normally the most satisfactory treatment



FIG 86 —The *saccular* varix These large dilatations are commonly seen at the sites of entry of incompetent perforating veins, and may require special management in the stripping operation (*see* Chapter 8)



FIG 87 —The *sapheno* varix This is a common variety of saccular dilatation occurring at the sapheno-femoral junction It may be mistaken for a femoral hernia The greatest care is required in performing the "top-tie" prior to the stripping operation as the varix is often excessively friable



FIG 88.—
The "*athletic*" vein. This type of vein is found most commonly in young, thin, active men. The vessel is prominent rather than varicose, although there may be some mild sacculation. The condition progresses only very slowly and operative treatment is seldom required.



FIG 89.—The *senile* type of vein. This variety is seen in the older patient of thin build. They are very similar in appearance to the previous type, but are thick walled and atrophic. Varicose dilatation seldom occurs. No treatment is required.



FIG 90—"*Roller*" veins These veins are a local form of the senile variety occurring normally around the ankle They are very thick walled owing to previous thrombosis and have no significance other than cosmetic Local avulsion through small incisions may be demanded by the patient The small silver wire stripper may sometimes pass



FIG 91—"*Hair*" veins These are clusters of minute intracutaneous vesicles and are also known as "*spider-web*" or "*sky rocket*" veins They tend to occur on the back of the thigh in obese menopausal women No form of treatment is required other than for cosmetic reasons



FIG. 92.—*Arterio-venous* varices. These are congenital in type, appear rapidly early in life and are secondary to an arterio-venous fistula in the limb. The limb may be hot and swollen and pulsation may be felt in the veins. Ulceration is common. Extensive and complicated surgical treatment of the fistula is required.

BIBLIOGRAPHY AND REFERENCES

(*All references for this Chapter are to be found at the end of Chapter II*)

CHAPTER 7

TREATMENT—A GENERAL SURVEY

THOSE who have read the chapter on the historical landmarks in treatment will realize that over thousands of years the elusive varix has been a most stubborn foe, and it is only in recent times that the subject has become sufficiently specialized for us to be able to offer our patients not only relief, but in the majority of cases, that which is commensurate with cure. Even so, we must always remember that varicose disease is of a progressive nature and that whatever form of treatment we give, all of our patients require periodic supervision. Again, we must always keep a most important rule before us and that is not to undertake treatment which carries an unnecessary risk It has been pointed out elsewhere that varicose disease is of a non-lethal nature and we must try to be as conservative in our ideas as the case allows

There is no routine treatment of varicose veins and our therapy of this condition is not yet perfect *All cases of varicose veins of the leg, however, can be benefited by treatment* Neglect in providing the correct therapy allows the occurrence of incapacitating complications For the purpose of discussion it is necessary to divide the methods of attack on the varix into three categories

(1) Surgical treatment
(2) Supportive and compressive treatment
(3) Sclerosant treatment

It will be noted, however, that not all cases can be dealt with separately under these headings, since the majority require a combination of the methods which are at our disposal Whatever treatment we give, it must be remembered that the normal physiology of the venous system of the leg can never be completely restored

CLINICAL FEATURES INFLUENCING TREATMENT

As already discussed in Chapter 6, the general factors of age, longevity, type of work and general health all affect our decision regarding the therapy which we plan for each individual case We now turn to those features which influence our treatment when we make a local examination of the limb The questions which we have to ask ourselves may be summarized as follows

(1) *Are the valves of the internal and/or the external saphenous veins competent?*

We must first consider the question of the competence of the superficial veins, and the reader will already have noted the various tests by which this point can be settled To the experienced examiner, however, observation and palpation will be all that is necessary, in order to determine whether there is a gross incompetence of the valves of the majority of the saphenous veins which he examines A dilated saphenous bulb with a prominent, enlarged and easily felt internal saphenous vein in the groin tells us immediately that there will be but little function, if any, in that segment of the vein. The Brodie-Trendelenburg

and Ochsner Mahorner tests will confirm this point should the examiner wish so to do

It will not be long before the beginner is able to sort out those cases which require radical surgical treatment. These patients will be found to form the largest group in the varicose vein clinic Patients with minor varices unassociated with a gross enlargement of the main trunk of the saphenous vein usually fall into the group which requires either sclerotic treatment or possibly the local ligation and removal of the small varices

As previously discussed an important factor in the selection of our patients for radical treatment is that of age In other words the patient who is young has to face a long life, possibly complicated by pregnancy and other factors which



FIG 93.—Collateral circulation of varices of the abdominal wall Involvement of the ilio-femoral vein should be suspected in such cases.

may disturb the veins of the lower leg. These are the patients who should get the benefit of early operation In this way we are able to avert the inevitable complications which would ensue were they not to be so treated. As will be pointed out later owing to the large number of applicants for treatment it is better both from the economic and national point of view to give priority to this group

(2) *Is there any condition which might cause pressure on the superficial venous system?*

The question of external compression by means of a pelvic tumour or of a pregnancy should next be considered Pelvic tumours may sometimes press on the iliac veins and cause the superficial veins of the lower limb to become dilated and varicose. A careful pelvic examination in all patients who are suspected of such conditions should be made, even though this causation of varices is not common The question of the treatment of varices associated with pregnancy will be discussed later

(3) *Has the patient suffered from deep vein thrombosis? If so, did the varices develop subsequent to this incident?*

The question of the association of varices with previous attacks of thrombophlebitis of the deep veins must now be considered In these patients the determination of the condition of the deep venous system is one of importance, and the history of a previous attack of deep vein thrombophlebitis is an important pointer, which will make us examine the limb even more carefully. A gross blockage or a severe incompetence of the valves of the deep venous system presents the typical picture of " white leg ", which, if neglected as far as support is concerned, will develop the typical " champagne bottle " shape These cases of deep vein thrombosis of such severity are not suitable candidates for the active treatment of their superficial varices Saphenous veins in such cases may well be forming compensatory channels for the conveyance of the blood from the extremities It will be realized that these severe cases cause us little difficulty in their classification These patients require treatment directed to restoration of the function, partial or otherwise, of their deep veins Once this has been done, operation on the superficial system may be considered

It is the milder cases, showing a lesser degree of deep vein thrombosis, which form a definite problem as far as the treatment of their superficial varices is concerned The simplest method of testing these patients is by the bandage compression test As already described, a firmly applied elastic bandage serves to compress the superficial varices and cause the blood to return by the deep system only A 10-minute walk under such conditions will cause pain to the patient whose deep veins are inadequate to deal with the venous return under these conditions

Much has been written regarding the function of the superficial venous system as a compensatory adjunct in the case of deep vein blockage Obviously this compensatory circulation is of no value to the patient, in fact, it is an additional embarrassment to the venous circulation in the vast majority of cases, since the circulation is invariably retrograde In such cases nothing but good can come from the eradication of the superficial venous system A difficult point to consider, however, is *whether this circulation in the superficial veins is of any value to the patient when he is lying down.* It is conceivable that under such conditions these varices might be of some use to him From a practical point of view, however, improvement ensues when the superficial veins showing this retrograde circulation are obliterated The patient under these circumstances must not be promised a cure and must be made to persist with treatment directed to the improvement of his deep venous circulation after operation This means that for a long period he may have to persist with elastic bandages, exercises and physiotherapy. Under such circumstances a vast number of patients suffering from deep venous insufficiency improve over the months and years As will be pointed out later, so much, however, depends upon the willingness of the patient to carry out the treatment

From the practical point of view, the co-operative patient suffering from the combination of superficial varices and the results of deep vein thrombosis can, as a rule, be made safe for operation in the following manner Her weight is brought to normal, elastic compression, massage and physical exercises are prescribed, and after a period of a few months, the majority of patients have slim limbs, showing

that the deep venous return has been improved considerably At this stage, the superficial varices are far more obvious and in my experience *nothing but good can be done by removing as much of the superficial system as is possible* I can but speak from experience and realize that I differ from certain general surgeons such as Dodd and Cockett (1956) who state in their book In our opinion the trunks of the varicose internal and external saphenous veins should not be stripped With the majority of patients I consider this to be the wrong advice and can but repeat that the careful stripping of varices can do nothing but good once the leg has become slim and we have satisfied ourselves that the deep veins are once again functioning sufficiently well to justify operation Needless to say incompetent perforators and communicating veins are dealt with at the same time I repeat that I am unable to agree with the view that the diseased channels of the saphenous vein should be left in situ, when the deep veins have suffered past damage



FIG 94 —Severe varices of the lower leg associated with eczema, ulceration and oedema. Such limbs require compression, massage and exercises prior to operation on the superficial system. Skilled massage will provide limbs fit for operation in a few weeks.

(4) *Does the patient suffer from an indurated limb with ulceration?*

As a general rule it is far better to treat these patients along conservative lines until the deep venous system has either shown signs of improvement or conversely has failed to react to treatment. In other words treatment must be directed towards removal of the static oedema and of the induration before considering any active measures

It is far better to delay operative treatment until we have a slim limb with a healed ulcer Modern techniques of massage and elastic bandage compression will produce this result for us with the majority of patients (*see* Chapter 16) If the ulcer cannot be healed along these lines for various reasons we may choose the alternative of stripping the internal saphenous veins *from above* down to the ulcerated area, and then continuing with our physical treatment. This method

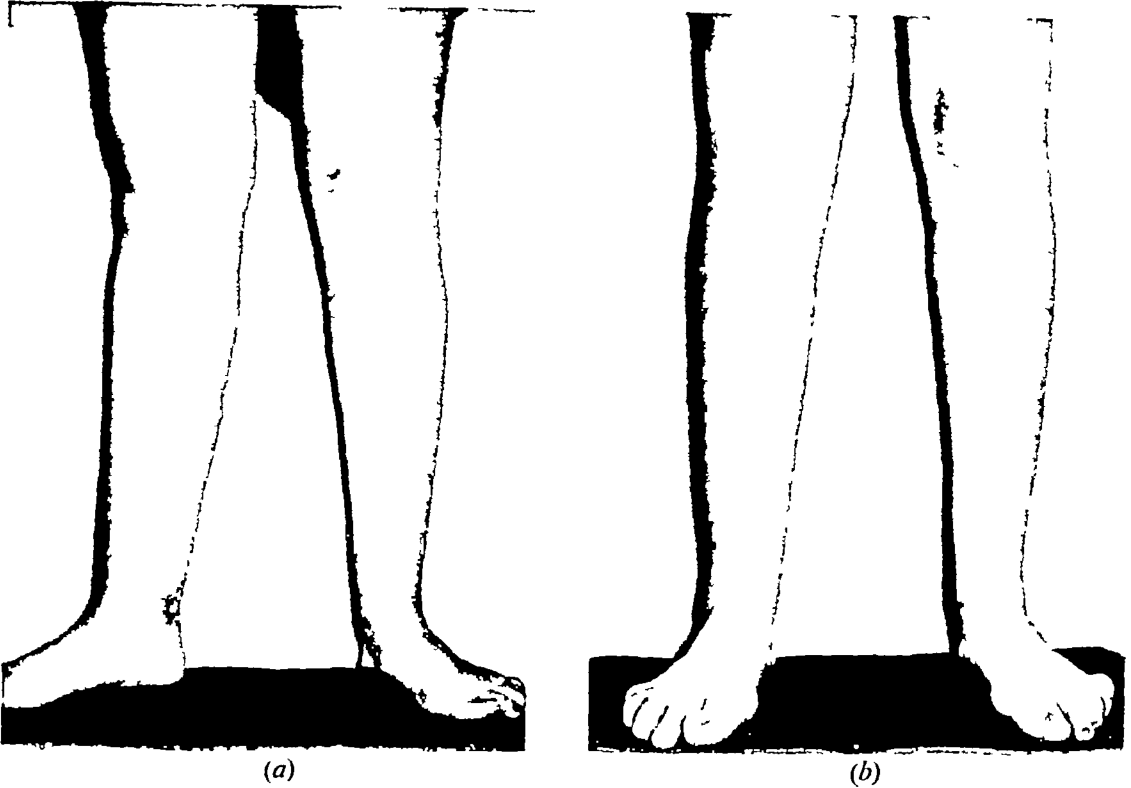


FIG 95 —(a) Deep vein thrombosis of the right leg with severe superficial varices and a pre-ulcerative condition This limb requires massage and compression treatment prior to stripping superficial varices (b) The same limb after stripping The picture is shown to emphasize the importance of getting the limb into condition prior to operation Note the improvement in the shape of the limb, in the colour of the foot, and in the skin discoloration Post-operative massage and exercises were necessary in order to get this result

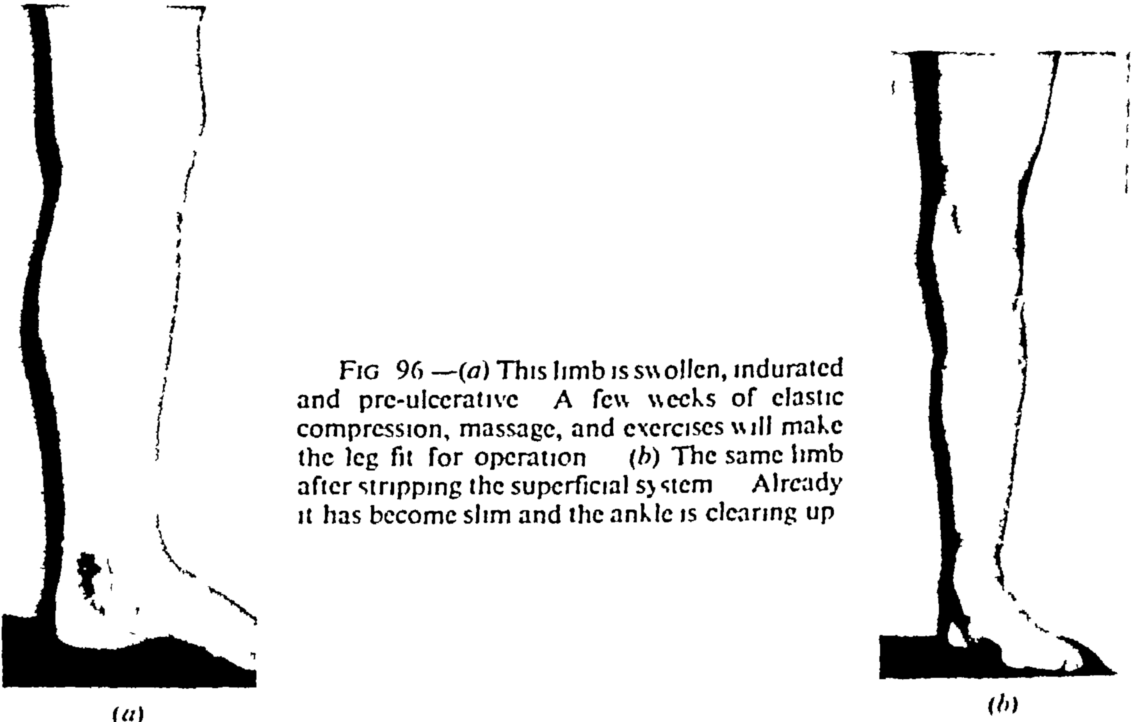


FIG 96 —(a) This limb is swollen, indurated and pre-ulcerative A few weeks of elastic compression, massage, and exercises will make the leg fit for operation (b) The same limb after stripping the superficial system Already it has become slim and the ankle is clearing up

may help to heal the ulcer more rapidly and on occasions we combine this stripping with grafting and the excision of obvious blow-outs around the ankle I am against cutting into the ulcer itself until after it has been healed for a considerable length of time At this stage, we may well find that radical surgery to the ulcer bed is not called for since it is only the exceptional ulcer that requires the radical treatment which is being recommended by some surgeons These matters will be more fully discussed under the treatment of the indurated limb and are only being considered at the moment to point out in what way the presence of an ulcer influences our treatment of both the deep and superficial venous system

PREVENTIVE TREATMENT

At the present time no prophylactic or preventive treatment is known and time and research could well be spent in this field of preventive medicine. There are plenty of facts in the aetiology of this widespread disease which act as pointers in its preventive treatment For example the effect of certain ductless glands on the development of varices has been recognized since the days of Sicard Early pregnancy is known to make varicosities considerably worse before the factors of compression of the pelvic veins or even the engorgement of these veins have been brought into play Similarly both the menopause and puberty are recognized times at which varices might make their first appearance or be made considerably more evident. Treatment by means of the administration of antagonistic hormones has been attempted but the results have been most indefinite.

Since varicose disease may be considered to be a progressive degenerative process preventive treatment must tend only to slow this up All patients presenting a family history of varices should be regarded as potential sufferers and should be advised to be careful in the selection of their occupation Prolonged standing may prove to be the additional factor in the development of subsequent varices The examiner in an antenatal clinic must always be on the look out for early varices during pregnancy since adequate supportive measures, periods of rest and periodic elevation of the limbs may tend to slow up the progress of the disease. Preventive treatment of ilio-femoral thrombophlebitis has been referred to elsewhere and this in itself may prevent many cases of secondary varices from developing.

CONTRA INDICATIONS TO ACTIVE TREATMENT

The contra indications for active treatment may be summarized as follows

Advanced age in combination with severe varices

In those cases of advanced age in combination with severe varices the life expectancy must be considered before taking active measures Age in itself is no contra indication to operation and the last few years of life may be made more comfortable for many if surgical measures are adopted In the frail and senile, however it is better to give a good trial to conservative methods before advising any more radical treatment Thanks to the improvement of technique in the stripping operation, age is not such a contra indication as it was in the past We are now able to perform the operation far more rapidly and with less trauma The technique is better and antibiotics are an additional help For all these reasons we can now offer patients in healthy old age the advantages of surgery

Pregnancy

The majority of pregnant women suffering from varices are better treated by means of conservative supportive measures Those, however, who give a history of previous attacks of phlebitis or who are in a pre-ulcerative condition in spite of being treated by means of supportive or compression treatment may be submitted to surgery during the early months of pregnancy. It should be remembered, however, that varices disappear in a remarkable manner after parturition and that treatment may then be either unnecessary or much easier to administer. Care must be taken in the use of sclerosants at this time owing to the ill effect they may have on the foetus The usual advice to the pregnant patient with varices is to avail herself of elastic stockings in combination with the occasional use of two-way-stretch bandages Periods of rest with elevation of the limbs are naturally helpful Leg exercises are necessary immediately after parturition

The chair shown in Fig. 191 is invaluable throughout pregnancy Patients using this method of elevating the limbs need not be confined to bed, and are able to keep the varices empty of blood by frequent short rests The chair will keep the limbs in good order during this difficult time and will allow the patient to carry out many of her duties whilst in this position, which would not be possible if she had to use a couch.

In combination with leg exercises, regular massage to the elevated limb is all important In fact, massage, leg exercises, and rest with the limbs elevated will see the majority of pregnant patients through their troubles

A more detailed discussion on the treatment of varices in pregnancy will be given later and it will then be found that many workers disagree with the author's views, in particular, Solomons (1950) discusses his results with the sclerotic treatment of the veins of pregnancy

The timing for operative interference is something we gain after prolonged experience For example, the newly married young woman presenting moderate incompetence of the internal saphenous vein may well ask us whether the operation should be performed before she becomes pregnant, or after the baby is born As a rule I advise such a patient to wear elastic stockings throughout her pregnancy, and to have the offending varices stripped after parturition. In this way the patient has " earned her operation ", making the varices worse during her pregnancy and allowing us to put the leg into order at this later date The alternative of operating before the pregnancy, in my experience over the years, appears to give an inferior long-term result It can be seen, however, that no exact rule can be laid down, and obviously if this patient is likely to run any marked risk of phlebitis or ulceration during her pregnancy, it is better to tackle the matter before she undertakes her planned pregnancy

Debilitating disease

Patients suffering from *congestive heart failure* should be treated by conservative means, since the outlook for life is not good, added to which there is an increased risk of extending venous thrombosis if sclerosants are used. Similarly, in *carcinoma* and *severe renal disease* the prognosis so far as life is concerned does not justify active measures In diseases such as *diabetes mellitus*, *hyperthyroidism* and *active tuberculosis* the disease itself should receive treatment and be under control before anything else but conservative measures should be adopted for the

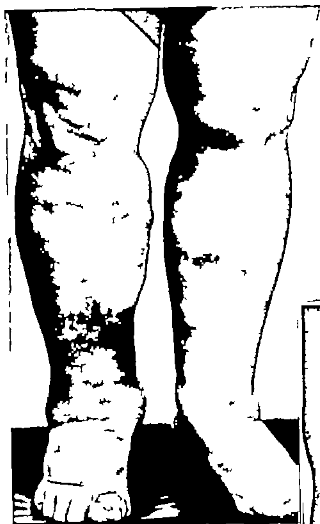


FIG 97 —Bilateral oedematous limbs in a patient suffering from cardiac disease. In addition, severe varices are present, and the right leg is the seat of deep vein thrombosis. Needless to say *these limbs should be treated by conservative methods only*



FIG 98 —A posterior view of the case shown in Fig 97 The majority of the varicosities are masked from view owing to the extensive oedema of the tissues.

co-existing varices In cases of *severe anaemia* conservative treatment should be adopted until the blood picture has been corrected since such patients are particularly susceptible to massive thrombosis if surgical or sclerosant measures are adopted In *arteriosclerosis* and in *Buerger's disease* many surgeons advise conservative treatment only. If, however, the diseased superficial venous system is causing an added embarrassment to the circulation of the limb, nothing but good can come from operation It must be remembered, however, that wounds do not heal kindly in these cases and that sepsis is more likely to supervene Considerable judgment is required and all cases should receive treatment on their merits

The patient with varicose veins must be regarded first as a patient and secondly as a sufferer with varices His general health, occupation and expectation of life must be taken into consideration Active treatment should be replaced by conservative measures if the patient's immediate state of health might add risk to an operation which in itself is non-lethal Clinical judgment and experience following a complete examination of the patient are needed in forming an opinion as to the proper treatment

The sequelae of deep vein thrombosis

The past history of a deep vein thrombosis and the presence of partially recanalized deep veins are indications for conservative treatment until careful testing and observation have convinced the surgeon that the diseased superficial varices are serving no useful purpose and that the retrograde circulation in fact forms an embarrassment to an already damaged deep vein circulation When such a stage is reached, there is no contra-indication to surgical treatment Prior to operation these limbs require elastic bandage compression, massage and exercises Furthermore, the patients may require weight reduction before they are fit for surgery

Pelvic tumours or extravenous obstruction

The presence of pelvic tumours or of an extravenous obstruction to the return of blood is an indication for conservative treatment of the varices until the cause has been dealt with

Patients confined to bed

It is unwise to submit a non-ambulatory patient to surgical treatment. It is not uncommon to find that surgical treatment has been directed to the varicosed limbs of a patient who at the same time has been operated upon for some other condition such as haemorrhoids An added risk of a deep vein thrombosis is thus taken and no avoidable risk is justifiable in the treatment of varices

Varicosities of the vulva

By far the commonest cause of vulval varices is *pregnancy* The majority of women are able to get through their pregnancy satisfactorily with vulval varices, but in some cases very extensive varices may occur, especially at the time of parturition If such a complication is suspected, we are then forced to adopt surgical measures which are described later in this manual I have received letters from surgeons dealing with the coloured races in Africa, who say that

fatal haemorrhage from vulval varices is a not uncommon complication I know of no reason why this should occur more commonly in the negress but it appears to be so



FIG. 99—Severe varices of the vulva.

To summarize

(1) The approach to the varix should err on the side of conservatism, for it is not a lethal complaint.

(2) The surgical treatment of the superficial system depends on the state of the deep system If the latter is faulty it must be given first consideration

(3) The conservative and supportive treatment of uncomplicated varices is simple but needs proper understanding.

(4) Sclerosants still have their place for post-operative trimming up and for cosmetic reasons

(5) Age, longevity health job and recreations all have to be considered when estimating the treatment necessary

BIBLIOGRAPHY AND REFERENCES

(All references for this Chapter are to be found at the end of Chapter II)

CHAPTER 8

TREATMENT BY SURGICAL MEASURES

NOW THAT the deficiencies of sclerosants are fully realized, the surgical treatment of varices has become the most important method of attack and I estimate that at least 80 per cent of our patients who present themselves at a hospital clinic require some form of surgical intervention It is therefore, all the more important for us to realize that varicose disease although progressive, is essentially a non lethal complaint This fact must be kept in mind at all times since no risk is justified in the surgical approach to our patients Death from operation is a poignant tragedy when one realizes that the patient might well have lived a happy existence in elastic stockings Active surgical treatment should only be advised when we are abundantly satisfied that not only is the operation fully justified, but also that little risk will be entailed.

The indications for surgery have already been discussed in Chapter 7 but we may say that, in general, surgery is required for those limbs which are the seat of advanced varicose disease, and having incompetence of the valves of the superficial venous system Appreciating the fact that other things being equal patients with severe varices will eventually suffer from some or all of the complications such as oedema, ulceration, eczema or phlebitis, it is our duty to offer them the advantages of the surgical eradication of their varices As is mentioned elsewhere it is the severe cases which benefit most from this treatment and for which it should in the main be reserved Furthermore, those with advanced varices in early life should receive priority so that they may be saved from inevitable complications in the years which lie ahead Furthermore surgery is sometimes indicated in the treatment of those patients who have varicose veins and who are about to undergo pelvic or abdominal operations. This prophylactic treatment may well lessen the risk of both thrombophlebitis and embolism.

It is now realized by most surgeons throughout the world that the accepted surgical treatment of the varix, with but few exceptions may be stated as follows

(1) *The high resection of both or either of the internal and external saphenous veins with all immediate tributaries*

(2) *The complete removal of the main trunks and branches of both or either of the internal or the external saphenous veins by stripping*

(3) *The excision of faulty communicating veins and perforators*

For clarity's sake I have to be dogmatic on these points and relegate all alter native operations discussed in previous editions to the historical chapter There the reader will find details of the old methods of attack, such as traumatizing the intima of the vein, injecting sclerosants at the time of operation, local ligations etc. I know from personal correspondence that there are still surgeons who are practising some of the old techniques but I repeat, I would far sooner see them all placed in the historical chapter

Indications and contra indications

Although we have already discussed some of the indications and contra indications to surgical treatment, I feel that in this chapter it will be helpful to restate them I give you the list which Myers has published previously since they are clear and definite, and I entirely agree with them

(1) *Indications for stripping incompetent superficial veins*

(a) Large varicosities

(b) Stasis changes, such as dermatitis ulceration, pigmentation and chronic induration

(c) A history or evidence of a single or recurrent acute attack of superficial phlebitis.

(d) Incompetence of both deep and superficial veins with venous stasis in which the superficial veins are a definite factor

(e) Need for a prophylactic procedure

(2) *Contra-indications*

These may be classed as temporary, permanent and/or absolute

(i) *Temporary contra-indications to stripping*

(a) Recent deep thrombophlebitis or acute superficial thrombophlebitis.

(b) Weeping dermatitis anywhere on the body

(c) Suppurative disease anywhere on the body

(d) Acute and sub-acute stasis cellulitis of the leg

(e) Pregnancy

(f) Poor general health or poor condition after a recent operation

(g) Obesity

(h) Severe secondary anaemia with concentration of haemoglobin of less than 10 gm per 100 c c of blood

(i) Recent extensive sclerosing therapy.

(j) Early asymptomatic varicosities.

(k) Main complaint due to other diseases of the lower extremity, and

(l) Uncontrolled metabolic disease

(ii) *Permanent contra-indications*

(a) Marked arterial deficiency of the lower extremity

(b) Normal but prominent appearing veins

(c) Asymptomatic varicosities occurring during advanced age

(d) Severe deep venous insufficiency when mild varicosities do not appear to be a factor

(e) Chronic lymphoedema with minimal varicosities and also severe varicosities unless the patient understands that improvement of the lymphoedema cannot be expected, and

(f) Severe constitutional disease with poor prognosis

Most of the indications and contra-indications described above are self-explanatory At this stage, however, a few comments on the more controversial points are opportune

In the case of recent *deep vein thrombophlebitis* it is better that the stripping of the varices should be delayed for a year or two During that time support massage and exercises should be given, and the stripping of the superficial varices should be delayed until they are obvious At this stage it may be determined whether the retrograde circulation in these superficial varices is causing an added embarrassment to the faulty deep circulation

Acute superficial thrombophlebitis and its treatment are discussed elsewhere in this manual but in passing I would like to say that I do not agree with Myers's

advice that stripping may be performed satisfactorily a few days after the inflammation has subsided. I prefer to do an immediate high resection operation to allow the phlebitis to subside entirely and to delay the stripping until a much later date This I consider to be a safer procedure, and in certain instances it may well be found that it is a long time before the stripping is required, since Nature by causing adequate thrombosis after an inflammatory period, may well have kept the affected limb in good order for several years

The question of *obesity* as a temporary contra indication to operation is most important Not only is the operation rendered far easier and the incisions far smaller but the increased risk in fat patients of deep vein thrombosis and post operative embolism is avoided

Planning the operation

The careful planning of the operation or operations to be performed is of the utmost importance As examples of such planning, we have to determine whether the patient should be submitted to operative interference on one or both legs at the same time, or whether the internal should be stripped at the same time as the external saphenous veins

In order to assess such problems, the reader should study the typical venous patterns demonstrated in the many photographs in this manual Although we learn to recognize the commonly recurring venous patterns amongst our out patients they are in fact, so variable that it would not be possible to illustrate them all.

It is my invariable practice to re-examine the patient on the evening before operation With the patient *standing* in a good light, *all* varicosities in the legs are marked, as well as the main internal and external saphenous trunks throughout their length if they are varicose It is particularly important to mark *all large branches* joining the main trunks as well as all *palpable perforating branches* ("*blow-outs*") Remember that when the patient is lying on the operating table with the legs elevated, only the largest veins will be discernible *The rule is therefore mark everything*

Once the veins have been marked, it is possible to obtain a clearer picture of how the particular problem must be tackled at operation

The main trunk of the internal saphenous vein, even in the most varicose limb is usually constant, passing from just anterior to the internal malleolus postero-medial to the knee up to the sapheno-femoral junction This is an anatomical point to remember since this main channel is usually the easiest part of the stripping operation, being facilitated by the relative straightness of the vessel This fact is seldom obvious in a limb as varicose as that shown in Fig. 100 a the large tortuous varicosities being branches of the main straight trunk of the internal saphenous vein Unfortunately this channel may be reduplicated, most commonly by a much enlarged external accessory (*see* Fig. 100 e) and sometimes by a dilated internal accessory saphenous branch Rapid recurrence after stripping will occur if these points are not noted before operation. In any case, if the slogan "mark everything" is adopted, there will be few disappointments Even if severe varicosities are confined to the branches of an otherwise healthy trunk of the internal saphenous vein it is necessary to do a complete stripping, since experience shows that *once varices have become severe in the branches it is only a*

question of time before the normal trunks become diseased In the years before stripping became the standard procedure, I frequently excised local blocks of diseased branches, leaving the main healthy trunk alone These varices however, have nearly all recurred It is now my custom to do a complete stripping along the

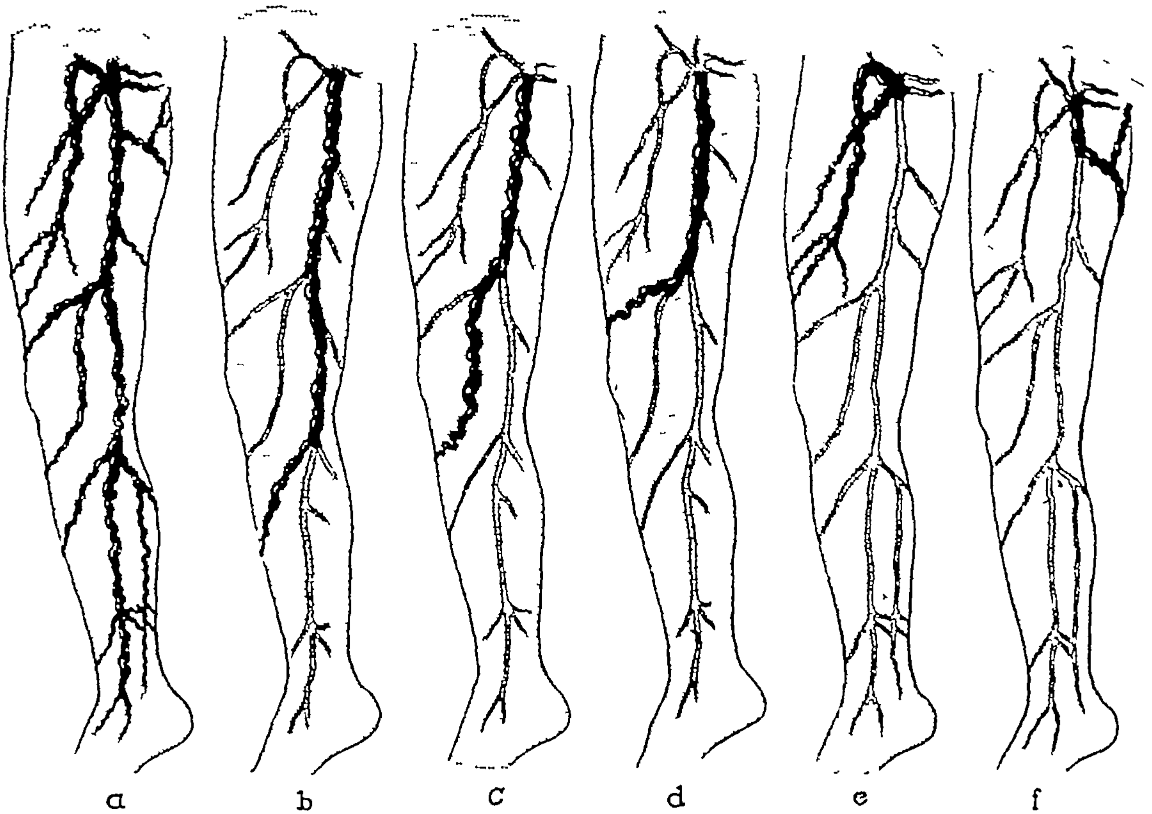


FIG 100—Common variations in incompetency of the great saphenous system of the right leg (*By courtesy of T T Myers in Allen, Barker, and Hines's "Peripheral Vascular Diseases"*)

lines suggested, even if it entails the avulsion of an apparently healthy portion of vein The more completely we eradicate the diseased saphenous system, the longer it will be before varices may occur in a regenerated superficial system later in life

For the comparatively young and healthy patient, it is often possible to perform a bilateral strip of both the internal and external saphenous veins at the same operation This is made possible by *teamwork* In other words, an expert assistant can halve the time taken over the operation A complete understanding between the surgeon and assistant surgeon working as a team develops in the course of time For example, the assistant can be suturing the incisions whilst fresh ones are being made on the other limb etc It is not wise for two surgeons to operate on each limb separately at the same time They are apt to get in each other's way, and little if any time is therefore saved

In order to safeguard the patient from all risks of deep vein thrombosis, it may be wiser to stage the procedure into two separate operations if more than one to one-and-a-half hours is likely to be taken over the combined procedure This is

particularly important in the older or less fit patient In the case of the healthy young adult, if many perforators are present as well as incompetent bilateral saphenous veins a second operation may be necessary in any case in order to get the limbs perfect. In such a case the surgeon may feel it wiser to perform the stripping of the internal saphenous veins only at the first operation, dealing with the obvious blow-outs at the same time The second stage will then consist of removing the external saphenous veins and dealing with any blow-outs which

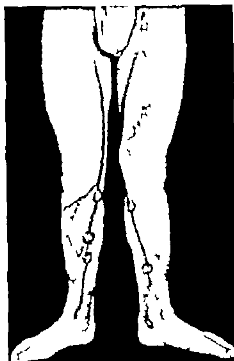


FIG 101 —Pre-operative marking of a fairly typical case of bilateral varicose disease of the internal saphenous vein. Incompetent communicators and perforators are marked with a circle and all large joining branches are marked, as well as the main trunk.

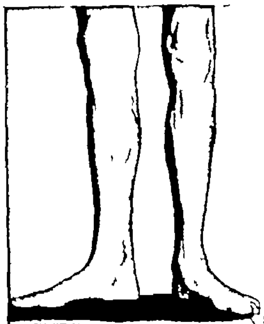


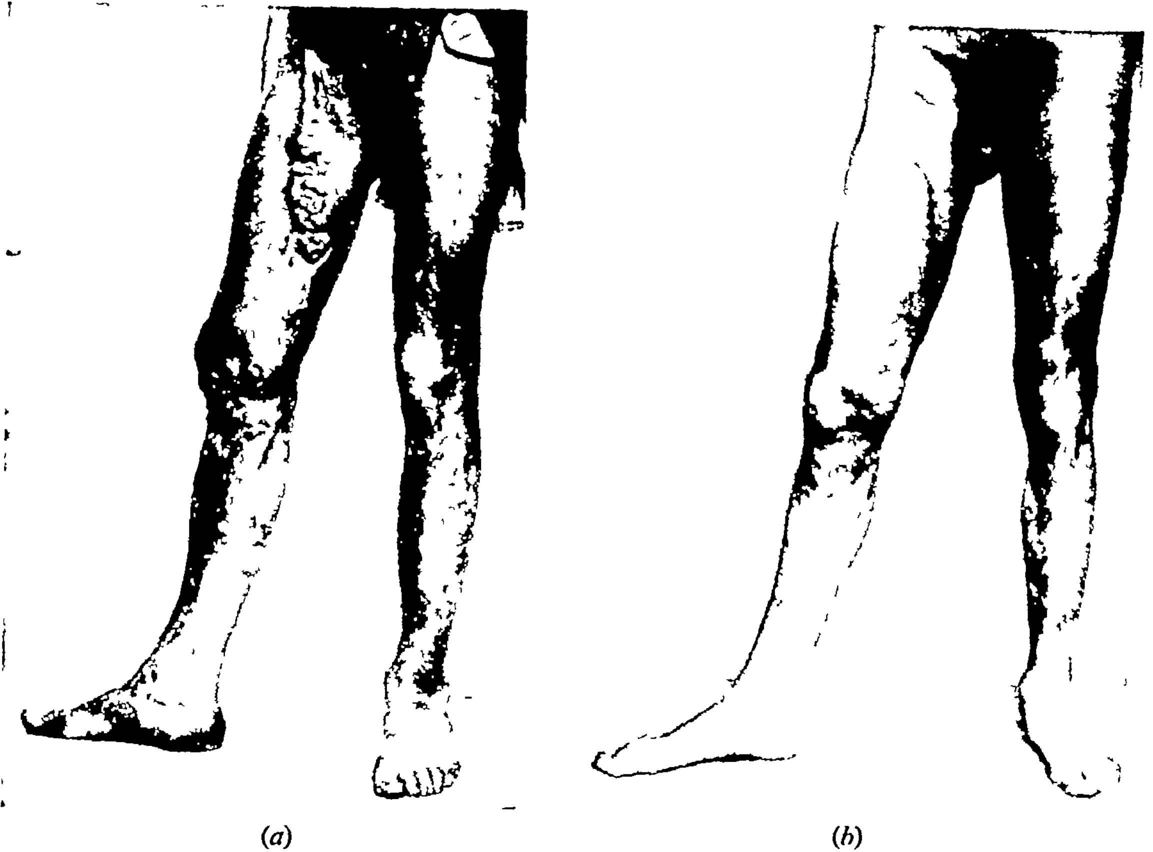
FIG 102.—This patient was 6 ft 5 in. tall and 48 years of age. The points of interest in his case are that so often these very long legs develop varices. In addition, it is to be noted that an ankle flare is present without any obvious perforators or evidence of deep vein thrombosis. It is as well to make sure that a stripper with an extra long wire is available for this abnormal long leg, otherwise difficulties may be encountered.

have not reacted to the previous surgery The surgeon will often be surprised however to find that the planned second stage may not prove necessary

With an elderly patient with very extensive bilateral varices a two-stage operation is usually necessary Here again the planning is variable Sometimes it is preferable to deal with the internal saphenous veins first, removing the external saphenous system blow-outs etc. at a later date If it is decided that the internal and external saphenous veins need stripping and can be done at one operation I find it preferable to do the external first, in most cases, rather than to turn the patient over on her face after the stripping of the internal saphenous veins By this means the risk of haematoma formation is greatly minimized

Taking the axiom that no risk is admissible in the non lethal condition of varices, *it is better to do too little than too much* at one session. With expert

teamwork, however, where the team includes a regular anaesthetist, and in which the assistant is as capable as the surgeon himself, the whole operation becomes far more speedy and safe I am sure that this is one of the operations in surgery which calls for specialized teamwork



(*a*) (*b*)

FIG 103 —A severe case of varicose disease (*a*) in which it may be advisable to perform a two-stage operation After a flush tie and a tie of the internal saphenous vein just above the knee, the main mass is excised through a long incision (*b*) At a later date the patient may be re-admitted for 48 hours for a stripping from ankle to knee These pictures are shown to demonstrate the necessity of planning the method of attack with certain cases *In this way no risk is taken and the patient is ambulatory* throughout treatment

To recapitulate, early ambulation after operation is essential If by doing a bilateral operation this early walking is prevented, it is better to deal with the limbs by separate operations Here the age, temperament and general health of the patient must be considered before planning the operation

Summary

(1) The planning of the operation is a most important part of the surgical attack when there is considerable varicosity of the superficial systems

(2) The choice of whether to do a bilateral or unilateral strip is considered

(3) The method of attack when both the internal and external systems are involved is discussed

(4) The advantages of teamwork are explained

Pre-operative preparation

The patient may either be admitted overnight or if the operation is taking place later in the day morning admission is justifiable A warm bath should be given a few hours before operation followed by a complete surgical shave The entire limb may then be prepared by means of a colourless flavine solution or cetavlon These substances being non-staining, allow the marking of the saphenous vein by means of an ink The use of this ink is particularly necessary in order to mark not only the main trunks of the saphenous veins but also all large branches and perforators The skin ink used by the author has the following formula

Pyrogall	1 gramme
Sp Vin Meth.	20 millilitres
Liq Ferri Perchlor	2 millilitres
Acetone	10 millilitres
Acid Hydrochlor	1 drop

If the ink is applied well before the time of operation and allowed to dry it will not rub off when an antiseptic is applied to the skin in the operating theatre.

Alternative methods of marking found to be satisfactory are the use of a ball point pen or as advised by Fratkin and Jackes (1951) Brazilian dye a black leather stain which may be obtained at any cobbler s Again some prefer to use Indian ink A further satisfactory method is to use an ordinary indelible pencil dipped into a mixture of acetone and spirit.

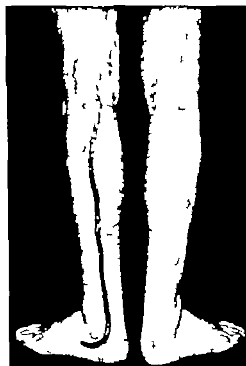


FIG 104 —The marking of the external saphenous vein prior to operation The knee is kept bent so that the termination of the external saphenous vein is readily felt.

Anaesthesia

General anaesthesia is preferable not only for the high resection of the internal saphenous vein but certainly for the stripping of the main varices In some clinics local anaesthesia is the rule for these operations but I can but say that no-one would be allowed to strip my legs under these conditions!

When a high resection operation without stripping is indicated, such as that dealing with an acute ascending superficial phlebitis, local anaesthesia is per missible

Local anaesthetic agents

(1) *Lignocaine* (Xylocaine—Duncan Flockhart & Co Ltd.) in an aqueous solution of strength ½ per cent or 1 per cent is the best long acting local anaesthetic Adrenalin 1 1 000 may be added Two minims in 1 oz. of solution is adequate. Toxic effects are not often seen, but dosages exceeding 40 ml of ½ per cent or 20 ml

of 1 per cent may give rise to muscular twitching The addition of Adrenalin allows higher dosage before these effects are seen

(2) *Procaine* in a solution of ½ to 1 per cent is still favoured by many, but I prefer Xylocaine The same amount of Adrenalin solution may be added to either solution A small bleb should be raised by means of a fine needle 1 inch lateral to the pulsating femoral artery The long, pliant shaft of a spinal needle attached to a 20-millilitre syringe is all that is then required The needle must be kept moving whilst injecting so as to avoid the possible risk of discharging the contents into a blood vessel The first delivery of anaesthetic should be made along the line of the intended incision Subsequently the needle should be allowed to travel above this line so that the descending cutaneous nerves may be blocked by the anaesthetic solution in their course After 10 or 20 millilitres of 1 per cent procaine have been injected, gentle massage over the area hastens the diffusion of the anaesthetic and the patient is then ready for the incision after a few minutes

Anaphylactic reaction to procaine and lignocaine —This is fortunately a rarity, but is one which we may all encounter when using local anaesthesia The warning symptom of impending collapse is that of tachycardia Procaine, when injected into the tissues, is less likely to give rise to trouble than when injected intravenously, and Langton Hewer (1947) warns us that it is not the total dose which matters but *the rate of injection The symptoms usually occur in the following order tachy-*cardia, muscular twitching, convulsions, respiratory failure, and death From the practical angle, when using large quantities of 2 per cent procaine as a local anaesthetic the substance should not be injected too rapidly and note should be taken of any complaint In the event of toxic symptoms intervening, a quick-acting barbiturate injected intravenously is the best antidote Pentothal Sodium is an excellent example It is of interest to consider that the use of Nembutal as *a pre-anaesthetic may possibly minimize the risk of procaine toxicity*

Should the reader wish to strip the internal saphenous vein under a local anaesthetic, I refer him to Dodd and Cockett (1956) or to the writings of Nabatoff (1953) These surgeons block the femoral nerve just external to the femoral artery, and then anaesthetize the lower end of the internal saphenous vein The technique is not easy, and I can but repeat that I am very much against it In Great Britain the standard of general anaesthesia is very high indeed, and I emphasize that Thiopentone and light gas anaesthesia is the ideal If a patient is unfit for general anaesthesia, he is rarely, in my opinion, a suitable candidate for stripping

I append a few comments on general anaesthesia made by Dr Robert Ballantine of St Bartholomew's Hospital, London I do this, since this part of the operation is so very important

"*Notes on General Anaesthesia for Varicose Vein Surgery*

(1) General anaesthesia is rarely contra-indicated, and with the drugs available today causes little post-operative upset

(2) During the administration, coughing straining and respiratory obstruction with even mild anoxia or carbon dioxide retention will cause venous congestion at the operation site This must be avoided

(3) Recovery is rapid, so that exercises can be started early



FIG 105—Position of patient on operating table for top tie and internal saphenous stripping. Note the use of the non-slip mattress which allows full tilting without the danger of shoulder rests. The degree of tilt shown here is more than is usually required unless the varices are particularly large



FIG 106.—Position of patient on operating table for external saphenous stripping. Note that the feet should extend beyond the end of the table

The positions used present anaesthetic problems

A Prone position (often combined with a steep head-down tilt)

(4) Regurgitation of stomach contents can occur, and an oral cuffed endotracheal tube is passed to prevent inhalation of this material The tube is left in place, with the cuff inflated, until the patient has been turned to the supine position and the mouth and pharynx sucked out at the end of the operation

(5) Respiratory movements are hindered by abdominal compression and a head-down tilt Controlled positive pressure respiration is necessary to ensure good pulmonary ventilation Some obstruction of the inferior vena cava and venous return may also result from abdominal compression (Pearce, 1957) and the position is arranged to allow the abdomen and chest as much freedom as possible

(6) Hypotension may occur when the patient is turned to the prone position but rarely requires the use of vasopressor drugs Postural hypotension may likewise follow return to the horizontal plane if this is too rapid In the post-operative period the foot of the bed is raised

(7) When turning the patient care is taken to avoid twisting the arms or neck, and a sorbo ring or gamgee pad is used to protect the face, and particularly the eyes, from pressure once the patient is in position

B Supine position

(8) A cuffed tube and positive pressure ventilation are only used in this position if a steep head-down tilt is required "

Position of the patient

When stripping the internal saphenous vein, the patient should be on his back with the legs widely separated on a board suitably padded to prevent pressure on the heels (*see* Fig 105)

When dealing with the external saphenous vein the patient lies prone with the ankles a few inches over the end of the table (*see* Fig 106) Since it is essential to have the patient in the Trendelenburg position for at least part of the operation, some means must be provided to prevent slipping I prefer to use the Langton Hewer corrugated rubber mattress rather than shoulder supports for this purpose, as it avoids any risk of brachial plexus injury

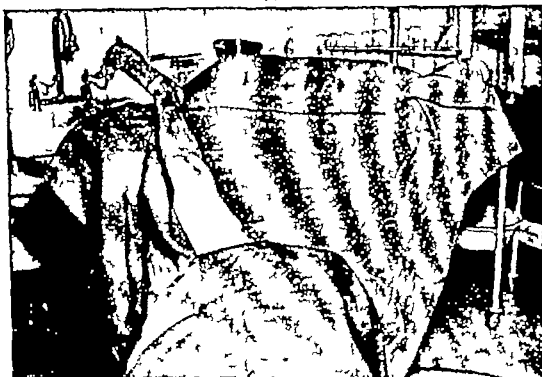
Position of operating table

During the time that the flush ligation of the internal saphenous vein is being performed it is as well to have the table tilted into a mild Trendelenburg position The table is moved into an acute Trendelenburg position a few minutes before beginning the actual stripping The patient is left in this position for 5 minutes after completion of the operation and is transferred to a bed which is already raised on blocks

Towelling of the limb

Each surgeon has his own particular method of towelling the limb prior to operation, but for simplicity the methods depicted in Figs 107 and 108 are recommended Note that a sterile glove is first fitted over the foot, this not only precludes any risk of infection from the clefts between the toes, but it also allows the surgeon to pick up the foot at any time without any risk of contamination The towels are so placed that during stripping no disturbance of their position may occur The

(a)



(b)

FIG 107.—Method of towelling the limb for stripping the internal saphenous vein As seen from (a) the side and (b) the head of the table. Note fold of towel at foot making " pocket " for instruments.

limb should be painted in its entirety from the glove over the foot to well above Poupart's ligament This is essential since one never knows at what point it may prove necessary to incise the limb

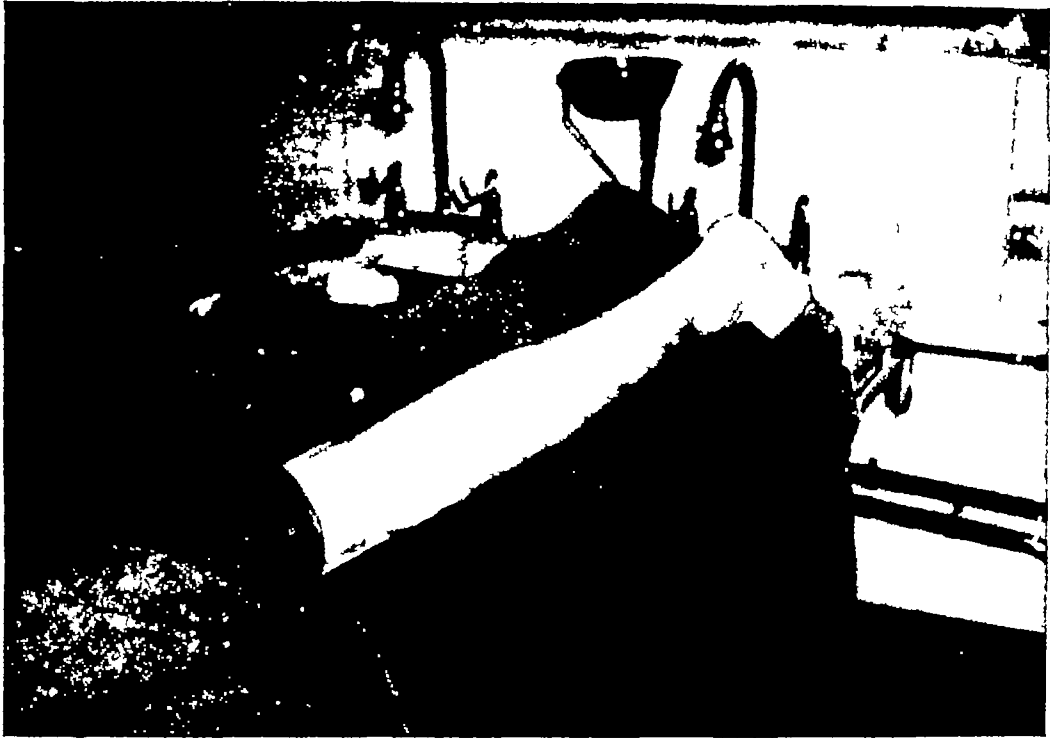


FIG 108 —Method of towelling the limb for stripping the external saphenous vein The whole area of the popliteal fossa must be exposed

Instruments required

The following is a list of the instruments required The minimal number of each is given, though others may be added at the discretion of the surgeon

Mosquito forceps, straight and curved (10)
Hand retractors (2)
Dissecting forceps (2 pairs)
Strabismus scissors (1 pair)
Fine aneurysm needles (3)
Self-retaining retractor (Foote's)
Forceps for Lahey swabs
Linen thread (size 90)
2 Myers type strippers (½-inch head)
1 short Myers stripper (¼-inch head)
1 long silver wire stripper
1 short silver wire stripper
Compressor (Foote's) (*see* Fig 111)
Plastic washers of various sizes
Mayo stripper

The Mayo stripper is seldom required, but is sometimes needed if the main trunk of the vein becomes shredded by the Myers stripper This is explained when the operation is discussed The small plastic washer I find invaluable, since it allows me to alter the size of the head of the Myers stripper at will

The self retaining retractor which I use has the following advantages

(1) It is so designed that it does not get in the way of the surgeon, the angle of the shaft being adjusted so that the retractor lies flat on either side of the wound

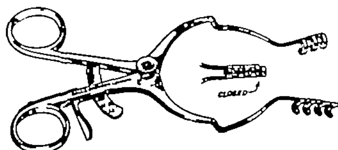


FIG 109 —The self-retaining retractor as introduced by the author is of considerable use in obtaining a wide exposure of the operative field. The teeth are not pointed so they cannot cause damage to the surrounding tissues, and they are more shallow than in other retractors of this type The jaws are bent downwards, thus keeping out of the way of the operator

(2) The jaws give a firm grip on the tissues allowing them to be lifted without slip

(3) The points of the teeth are so made that injury to neighbouring vessels should be avoided



FIG. 110 —Hand retractor

Catgut makes a suitable ligature material (size 00 plain) but I find linen thread (size 90) to be more satisfactory since it is easily sterilized by boiling is most reliable and is so easy to work with. All ligatures must be cut very short on the knot when using this material if stitch abscesses are to be avoided

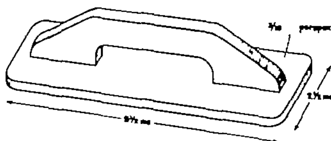


FIG 111 —Rowden Foote s compressor

OPERATIVE TECHNIQUE FOR THE INTERNAL SAPHENOUS VEIN

High resection of the internal saphenous vein

The terms saphenous ligation and in the United States of America, "top tie are misnomers since the essential point in this operation is the resection of the terminal portion of the internal saphenous vein together with a careful section

and ligation of all those tributaries joining the main branch at the sapheno-femoral junction

The operation now practised varies but little from that described by Homans in 1916 Most text-books describe the procedure briefly, claiming that it has become so standardized that a detailed description is not called for However, it is intended to describe this operation in detail, since it is all important in our treatment This operation is frequently performed without sufficient thoroughness, since the majority of cases present but little difficulty and tend to make the occasional surgeon attack the saphenous opening with impunity The average clinic presents unfortunate cases of recurrence resulting from slipshod high

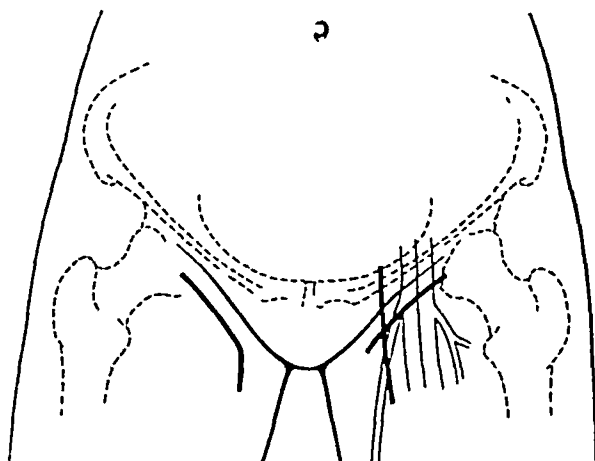


FIG 112 —Three of the most common forms of incision for exposing the sapheno-femoral junction The vertical incision begins above Poupart's ligament and in fat patients should be carried higher than in thin patients It lies roughly two finger-breadths medial to the pulsation of the femoral artery The transverse incision is best started over or just lateral to the femoral artery and carried in or just below the crease of the groin for an average distance of 2 inches The " hockey-stick " incision demonstrated in the right leg is merely the transverse incision which is carried vertically at its termination and this allows of a fuller exposure Do not try to do this operation through too small an incision (Ogilvie, 1946) As the patient is ambulatory, however, he must not be submitted to an incision of excessive length Delayed healing, owing to early movement of the limb, might be caused in cases subjected to wounds of excessive length

resections in which tributaries have not been ligated, or where a tributary has been ligated in mistake for the saphenous vein The details of the causes of recurrence are discussed elsewhere, however, and these remarks are merely directed to the reader in order to impress him with the importance of meticulous care in the performance of this operation

The reader is advised to refer to the anatomical details in Chapter 3 and Figs 50 and 51 which are illustrated on pages 51 and 52 to satisfy himself regarding the main anatomical relationships of the saphenous opening He should realize that this opening is extremely variable in size and shape and sometimes in position The saphenous vein has been shown both in the cadaver and at operation to have so many abnormal methods of termination that normality in this particular area is the exception Fig 54 (*see* page 55), taken from the diagrams of Daseler and his colleagues (1946), shows some of the varied pictures at the sapheno-femoral junction

The incision

Fig. 112 demonstrates three types of incision The legend under this figure describes the manner in which these are made The operation should not be performed through too small an incision and the mistake of commencing the transverse cut too much to the inner side of the femoral artery should not be made

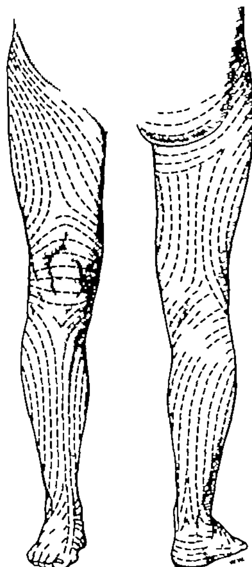


FIG 113 —" Langer's lines " first described in 1861 Whenever possible incisions in the lower limb should follow in the direction shown in the drawing. Tension of the skin edges will be minimized and this is of particular importance in ambulatory patients if satisfactory healing is to be obtained.

This error will make the approach to the sapheno-femoral junction difficult, this point being stressed by Ogilvie (1946) Too large an incision, however must be avoided since the patient is ambulatory and his comfort must be considered

In practice, we *always* employ the transverse (skin crease) incision and find it perfectly adequate for all but the most complicated cases A short vertical

extension downwards from the inner end of the incision is occasionally necessary for these It is imperative that the incision be placed high enough, i e , *never more than half an inch below the skin crease of the groin*

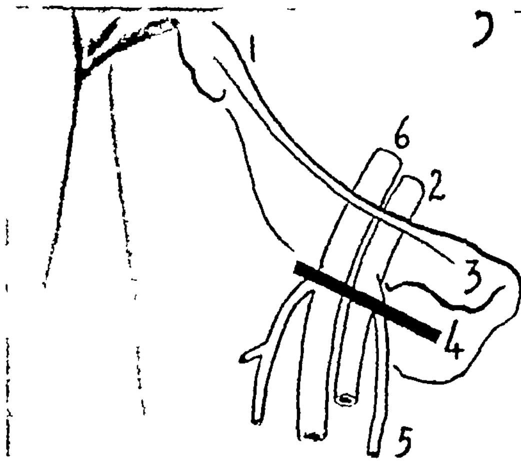


FIG 114 —The relation of the transverse incision to the femoral vessels 1=anterior superior iliac spine, 2=external iliac vein, 3=pubic spine, 4=transverse incision for high saphenous vein ligation, 5=long saphenous vein, 6=external iliac artery

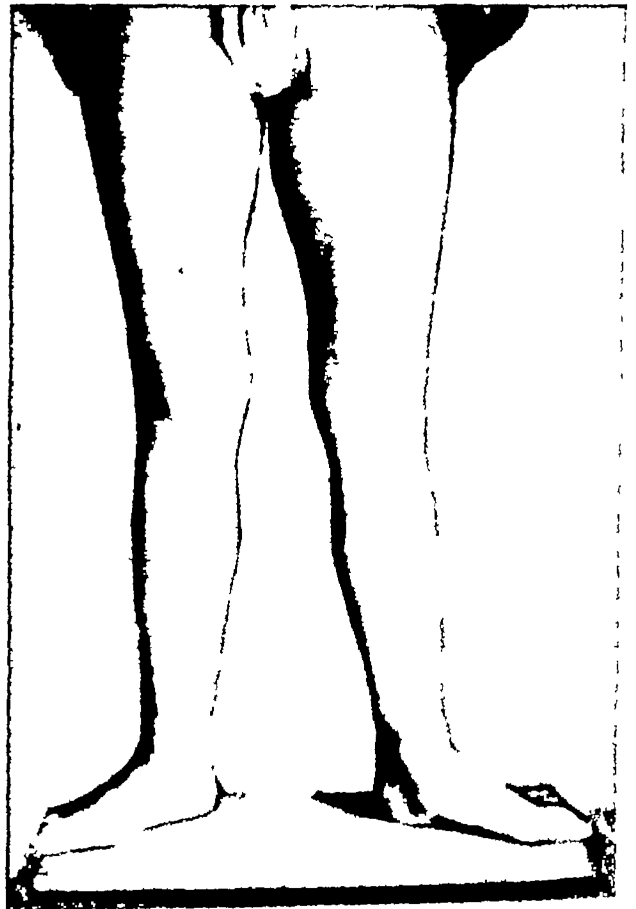


FIG 115 —The vertical incision made to expose the sapheno-femoral junction Although this type of incision produces a good exposure, the wound tends to heal badly In fat subjects this incision has to be made to extend above Poupart's ligament and it should be two fingerbreadths internal to the pulsation of the femoral artery Note the flat feet and poor muscular development so frequently associated with established cases of varicose veins

Exposure of the vein

The exposure of the vein may be much assisted by the firm elevation of the skin edges by means of tissue forceps (*see* Fig 116). This will allow the surgeon to use his knife quite boldly since the saphenous vein falls away from the covering

tissues. It is important not to put down the knife until the vein is exposed since in the obese it is quite easy to push the fat over the vein by means of blunt dissection, thus making the search prolonged. This can most easily be done by sweeping the adventitious tissue clear of the vein with the finger covered by a

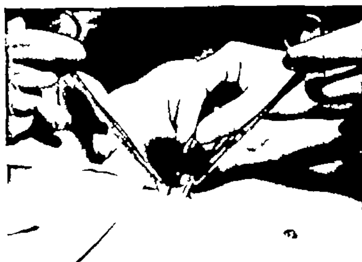


FIG 116.—Elevation of the skin edges is of the greatest assistance when incising through the subcutaneous tissues. By allowing the vein to fall away from these layers the knife may be used freely without fear of damage to the vein and a clean and rapid exposure is greatly simplified.



FIG 117.—Sweeping the adventitious tissues clear of the vein after its preliminary exposure by sharp dissection. This is best done before the self retaining retractor is inserted.

single layer of dry gauze One firm sweep upwards and downwards is all that is necessary to expose the main vein and the roots of all its tributaries Once the vein is exposed the self retaining retractor is placed in the wound *It is now* necessary to remove the fascial covering of the saphenous vein under local

anaesthesia this may be painful Discomfort can be avoided by the further administration of procaine into the covering, together with the use of sharp dissection either with the knife or sharp scissors rather than with a blunt dissection

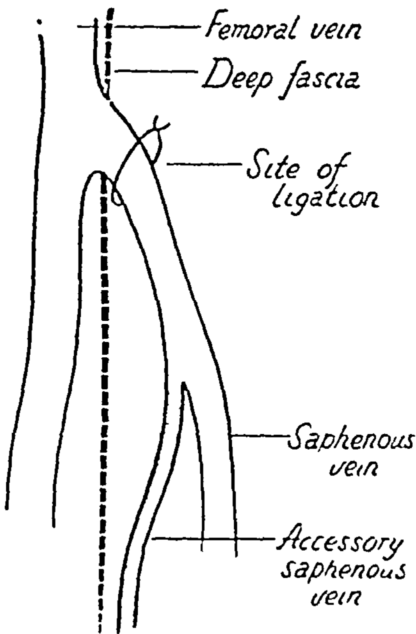


Fig 118—The common method by which an accessory saphenous vein joins the main trunk Note that this union occurs superficial to the deep fascia and ligation of this vessel does not present any difficulty

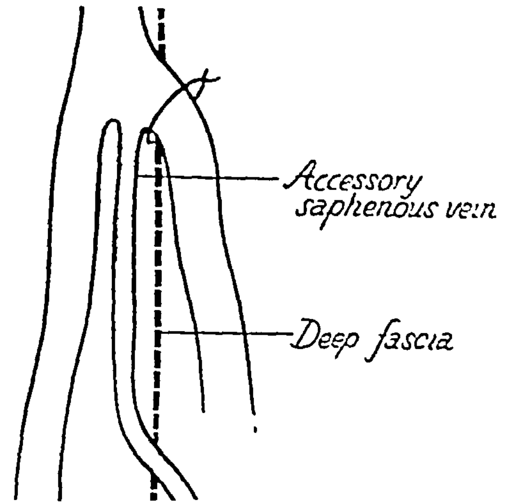


Fig 119—A method of union of this accessory tributary which is by no means rare It will be noted that in this case the accessory tributary pierces the deep fascia and lies superficial to the femoral vein parallel with its course Traction on the main saphenous stump may cause this tributary to be mistaken for the main femoral vein The surgeon who misses this not uncommon arrangement at the sapheno-femoral junction will fail to benefit his patient It is only by careful exposure of the femoral vein that this common method of recurrence may be avoided

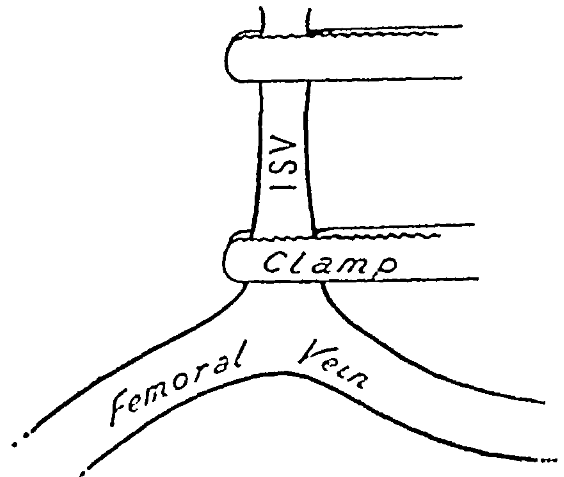


Fig 120—A clamp is being placed too close to the femoral vein in an over-enthusiastic attempt at making the sapheno-femoral ligation "flush" This method pulls up the anterior wall of the femoral vein and the clamp damages the intima of the vein which may cause thrombosis It is far better not to use a clamp in this situation but to apply a ligature after a gentle upward traction of the saphenous stump

technique It is most important that this vein should be divested completely of its fascial coat, since unless this is done, difficulty may be experienced in defining small branches and also in the upward dissection of the main trunk

Isolation of sapheno-femoral trunk

The next step in the operation is to divide the main saphenous vein about 1 inch below its termination and turn the proximal portion gently upwards The adventitious tissues are cleared *gently* from the underside of this vein as it is turned upwards until the lower sharp edge of the saphenous opening and the sapheno-femoral trunk joining the femoral vein can be clearly seen Lahey swabs or dental rolls held in a pair of forceps are most helpful in cleaning these tissues

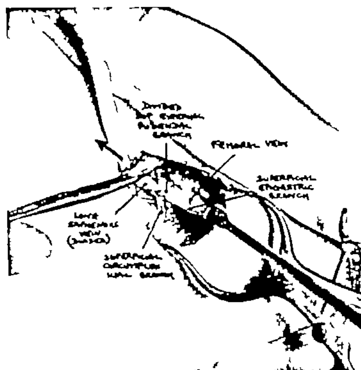


FIG 121 —After division of the internal saphenous vein gentle downward traction on the upper end helps to expose the lesser tributaries and facilitates their resection

from the vein but sharp dissection with a fine pair of scissors is frequently necessary for the sake of gentleness

In a certain proportion of cases the external pudendal artery crosses in front of the saphenous vein and may require division before the vein can be mobilized

In order to expose the tributaries joining the vein from above the saphenous stump is now drawn gently downwards This tenses the tributaries and makes them easier to free by blunt dissection and to divide between clamps or ligatures

Ligation of the sapheno-femoral trunk

When all the tributaries have been secured and ligated, the sapheno-femoral trunk is carefully inspected as it passes through the saphenous opening This is to ensure that no tributaries have been missed (*see* Fig. 119)

A ligature is now passed round the trunk and tied firmly ¼ inch from the femoral vein Damage to the intima of the femoral vein and its possible narrowing by ligation are avoided by *not* clamping the trunk before ligation (*see* Fig. 120)

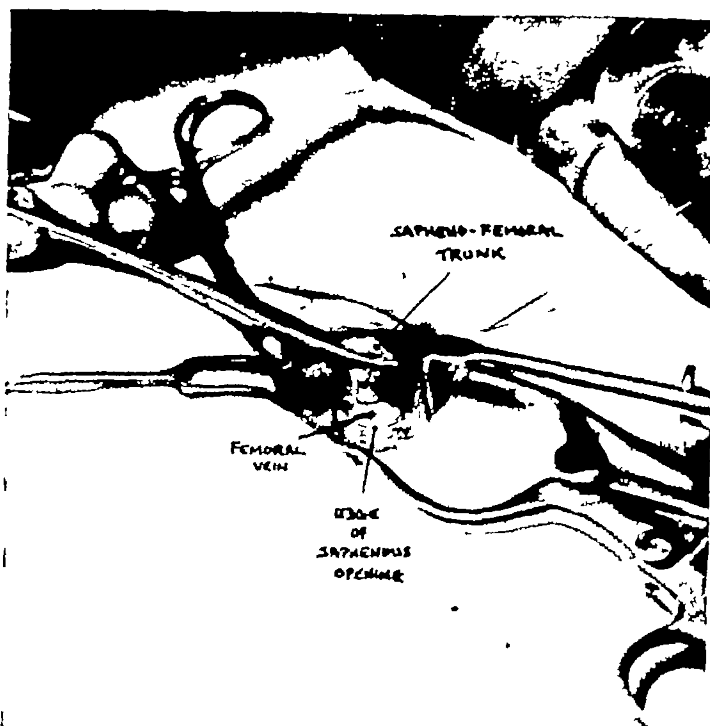


FIG 122.—After complete isolation of the sapheno-femoral trunk it is ligated ¼ in away from the femoral vein which must be seen. Care must be taken to avoid excessive traction on the femoral vein.



FIG 123.—After the sapheno-femoral trunk has been ligated, the lower cut end of the divided saphenous vein is mobilized by finger dissection to the limit of the retractor. Any tributaries found joining the main vein are resected.

Further security is afforded by placing a transfixion suture round the trunk ¼ inch distal to the first ligature. The redundant portion of the saphenous stump is then resected well clear of the second ligature.

The greatest gentleness must be exercised throughout the handling of the sapheno-femoral trunk as its walls are often tissue paper thin and extremely friable



FIG 124.—Mobilization of the lower end of the saphenous vein is now complete.

Mobilization of lower segment of saphenous vein

If the saphenous vein is to be stripped, the lower segment should now be mobilized By firm traction upwards the vein is put under tension and all adventitious tissue cleared by finger dissection to the limit of reach Any tributaries which are found joining the main trunk are clamped and divided This will avoid troublesome bleeding and haematoma formation when the main trunk is stripped

Dressing the wound

This is one of the few dressings which should be done by the surgeon himself (Fig. 125) A thick roll of gauze is placed over the incision, the patient's knee being flexed and the leg everted when applying the Elastoplast strapping over the pad When the leg is placed straight pressure will then be brought to bear on the wound This is important, since the patient is ambulatory and if this pressure strapping is not correctly applied haematomas may form. In hot weather it is advisable to cut a few windows in the Elastoplast cover since failure to do this may cause the wound to become soggy from sweat. In cases of allergy to plaster

the dressing may well be stitched to the wound, and if pressure is necessary, this may be given by means of a Spica bandage for a few hours



FIG 125—A method of applying Elastoplast over the dressing on the operation wound The patient's leg is everted with a bent knee The top end of the Elastoplast is applied firmly to the region of the crest of the ilium Straightening of the leg causes tension and pressure on the thick pad of gauze on the wound This simple point will save many haematomas and is a dressing which should be applied by the surgeon

Immediate post-operative treatment

The limb should be firmly bandaged from the toe to the knee and immediate passive or active movements encouraged for 5 minutes before the patient leaves the table On return to bed the patient should be encouraged to walk for a few minutes every 2 hours After general anaesthesia this may have to be delayed and movements in bed should be substituted Most patients are quite fit to leave hospital 24 hours after the operation The stitches are best removed about the seventh day The patient should be instructed that, during the week prior to the removal of the stitches, his activities should be limited He should be told that long periods of lying in bed are harmful and that sitting down for prolonged periods may cause even more harm The ideal for him to follow is periods of rest interspersed with short walks and exercise This advice needs stressing, otherwise many patients will return to bed and enjoy a week of invalidism, thereby greatly increasing the risk of deep vein thrombosis due to an overloaded and sluggish return of blood *via* the deep veins

I find it useful to supply the nursing home or hospital with routine instructions regarding the pre-operative and early post-operative care This

form may be modified according to the views of the surgeon, but is given below as a guide.

When the operation is in the afternoon the patient may be admitted in the early morning. Give a complete surgical shave and a hot bath. Operative field to be prepared with surgical spirit but sterile towels are not required. If operation is performed under local anaesthesia Nembutal grains 1½ may be given to a healthy adult 2 hours before operation and repeated 1 hour later At time of operation skin is prepared with 1 1 000 flavine in spirit. All thread ligatures must be boiled for 1 hour On return to bed the limb must be immediately exercised for 2 minutes and within the next hour the patient should walk around the room for a few minutes This should be repeated every 2 or 3 hours The limb must be firmly bandaged from toe to knee when the patient is walking. For discomfort Veganin may be given or morphine grain ⅛ (subject to no contra indication) may be given at night."

Some difficulties and special precautions

Identification of internal saphenous vein

Some surgeons believe that it is safer to isolate and divide all the lesser tributaries before dividing the main saphenous vein as this reduces the possibility of mistaking the femoral vein or artery for the long saphenous vein at the beginning of the operation (Dodd and Cockett, 1956) I can only say that I have used the method described in the text without anxiety for very many years Furthermore it is the method used by Homans and Dickson Wright.

In the very occasional case the identity of the long saphenous vein may legitimately be in doubt. It is well then to remember that the long saphenous vein runs in its own tunnel through the superficial fascia and can be wiped clean of fatty adventitious tissue with a gauze swab on the finger If this cannot be done easily then the vein is followed up to the sapheno-femoral junction and positive identification made before it is clamped and divided.

Rarely the long saphenous vein joins the femoral at a very much lower level and cannot therefore be found in the usual groin dissection. In such a case as this it is of the greatest assistance to insert the stripper from below before dividing any large veins at the groin. Its appearance in the groin will then identify the long saphenous trunk

Frequently there appear to be *two* long saphenous veins This is usually due to a marked enlargement of either the *internal or external accessory vein* with a normal sized long saphenous Identification is made positive by the arrival of the stripper passed up from below Occasionally however there is a *true reduplication of the long saphenous vein* throughout part or the whole of its length This finding necessitates special treatment when the vein is stripped, but nothing more in the groin dissection

Ligation of tributaries

It should not be forgotten that the anatomy of the sapheno-femoral junction is never constant. The only way to ensure a satisfactory clearance is to divide *everything* entering the sapheno-femoral trunk, however small it may be

I have drawn attention to a common fault previously (Foote 1953) and I believe this to be a source of recurrences after an apparently complete top tie

It is essential to seek out the circumflex iliac branch for a little distance laterally to ensure that it has no descending branch as shown in the diagram below. If one is present, then the vein must be divided at points B and C as well as at A to prevent a recurrence

While this comment applies most commonly to the circumflex branch, others may also exist The rule is, therefore, *any adjacent descending branch must be ligated*, however small it may be

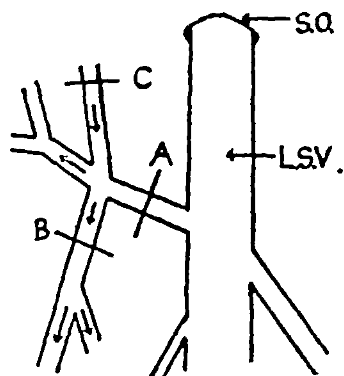


FIG 126—Ligation of branches of long saphenous vein A = site of usual ligation B, C = additional ligatures needed to prevent bypass L S V = long saphenous vein S O = saphenous opening

Complications of the operation

Accidents and injury to the femoral vein

Primary haemorrhage at the time of operation may be of the most alarming character There are numerous cases on record in which such haemorrhage has resulted in the death of the patient The usual position for haemorrhage to occur is at the sapheno-femoral junction and this may be occasioned by rough handling of the proximal stump when stripping it in an upward direction Again, it may happen when applying the ligature to the femoral wall. Too fine a thread and a clumsy technique may cause the tear It should be remembered that it is unwise to place the ligature " flush " with the femoral vein Always leave a small stump and tie the saphenous vein where it is healthy In other words, do not place the ligature around an obviously friable segment of the vein Leaving a short stump is all important in the case of primary haemorrhage, and we should give up using the term " flush ligation "

Even in experienced hands it is possible for a small tear to occur during dissection of a very friable sapheno-femoral junction Since this is, in effect, a tear in the side of the femoral vein, a sudden and very alarming haemorrhage occurs The immediate instinct of the inexperienced operator is to swab (ineffectually) and to seize hold blindly of the bleeding point with artery forceps in the depths of a rapidly increasing pool of blood Needless to say, this rarely stops the bleeding and can cause untold damage to the femoral vein, the results of which could be permanent.

Should such a mishap occur, the correct course of treatment is as follows

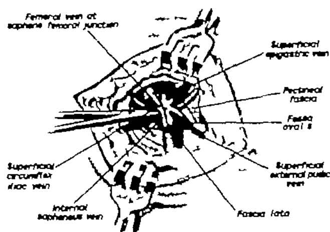
(1) *Don't panic*

(2) Apply *firm pressure* with a large swab for *five minutes.*

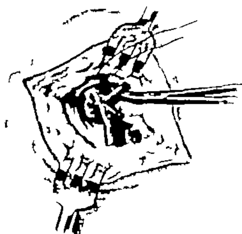
(3) Increase tilt of table to 30–40° Trendelenburg

(4) Do not put *any* instrument in the wound for five minutes

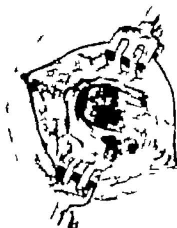
When this time has elapsed—*and not before*—the swab is removed and the bleeding point is clamped *at leisure under vision* If the first attempt fails, a further five minutes' pressure is applied and the clamping repeated



(*a*)



(*b*)



(*c*)

Three stages in the operation of high resection of the internal saphenous vein

Reproduced from Seminar International by courtesy of the publishers

Under no conditions should the operator be tempted to use his haemostats blindly The technique of performing the high resection operation as explained in this manual advocates strongly the section of the main trunk before dealing with branches This allows the upper segment to be twisted in the case of haemorrhage which would not be possible with the other techniques which are recommended In other words this method of performing the operation gives us far more control In addition the joining branches can be put on tension and can be clamped far more quickly by this method

If the operator is using the method of mobilizing the long saphenous vein described in the text, he will find that in very many cases the haemorrhage can be simply controlled by *twisting* the stump of the vein gently but firmly It must be stressed that gentleness is paramount. Any undue force used in this manoeuvre is likely to widen the tear and make things worse rather than better If it is thought that the femoral vein itself may be damaged no attempt should be made to twist the saphenous stump

It is seldom that these measures of deliberate and careful application of artery forceps after a period of prolonged swab pressure do not succeed in controlling the haemorrhage Just occasionally however it will be found that an actual tear of the femoral vein itself has been caused In this instance a lateral clamp is unlikely to be satisfactory and more radical steps must be taken

While controlling the haemorrhage with finger tip pressure the incision is widened and tissues separated and divided to give clear exposure of the femoral vein for at least 1 inch above and below the tear In some cases this may entail exposure of the external iliac vein above the inguinal ligament Haemorrhage may now be controlled by occluding the femoral vein by any suitable means (digital pressure temporary ligatures or special arterial clamps) *above* and *below* the tear The tear may now be repaired at leisure by a continuous suture using fine 6/0 arterial oiled silk atraumatic sutures

Happily these radical measures are seldom required but the operator should nevertheless be prepared for any contingency

Injury to the femoral artery amputation of the limb and death are on record in a few instances. Such complications are reflections on the ability of the surgeon and are fortunately rarities they usually occur when the surgeon is groping in a pool of blood for a torn femoral or saphenous vein.

Damage to lymphatics

Since the entire lymphatic drainage of the hind-quarter passes through the groin it is inevitable that any operation in that area is liable to damage lymph vessels It is therefore important to limit the field of dissection as much as possible compatible with adequate exposure of the veins All deep dissection should be kept to the vertical plane as far as possible and should be by gentle separation rather than sharp dissection Enlarged lymph nodes if present should be carefully preserved from injury So long as these simple rules are observed the post-operative complication of lymphorrhoea will be a rarity

Haematomas

A wound containing masses of varices, the walls of which may be thin and as friable as Dresden china is bound to be subject to a primary haemorrhage

occasionally This risk is made all the more possible owing to the fact that leg exercises and ambulation are essential parts of the operation A few practical points in the prevention of this condition are worthy of study. A careful ligation of vessels is essential, and a proper cleaning of the fascia from all venous branches is necessary prior to ligation A confirmation that all ligatures are secure may be made by asking the patient, if under local anaesthesia, to cough before closing the wound Dead spaces in the fatty tissues may be closed by means of interrupted sutures A self-retaining retractor may serve to prevent small vessels from oozing when it is in position, and it is not until the retractor is removed and the tension on the tissues is relaxed that a small ooze may commence It has already been pointed out that the pressure dressing over the wound must be applied with care, since this is an important factor in the prevention of haematomas

Treatment—This consists of evacuation of the clot as soon as the condition is recognized. This is usually possible by the removal of one or two stitches and gentle pressure on each side of the wound Failing the easy evacuation of the clot, it may be necessary to anaesthetize the patient, evacuate the clot and re-suture the wound Penicillin should be given for a few days

Lymphorrhoea

The complication of lymphorrhoea can be a very trying one, both to the patient and to the surgeon It may last sometimes as long as 3 months and a superadded infection is an ever-present risk Lymphorrhoea consists of a discharge of lymph through the partially healed wound This complication can be made less common if the glands overlying the sapheno-femoral junction are treated with respect. A transverse division of the glands and lymph vessels will give rise to lymphorrhoea in many cases The removal of the entire gland, or else its retraction from the field of operation, is the best method of dealing with these structures Once the condition has become established there is little that can be done except for frequent dressings and the reassurance to the patient that eventually the annoying discharge will subside

Sepsis

The groin of many patients is not a very healthy area. In those with pendulous abdomens and sweaty skins every precaution should be taken. The skin should be prepared for several days before operation with spirit and powder applications. Tineal infection should be treated with a fungicide Sepsis may be a dangerous complication if neglected, and once it is established immediate chemotherapy, with administration of penicillin, should be started.

Thrombosis of the deep vein

Deep vein thrombosis may develop after the operation of high resection of the internal saphenous vein, the usual antecedent cause being due to the failure in providing adequate exercises immediately after operation The signs, symptoms and treatment of this condition will be found in another chapter

Embolism

This complication should be rare provided that early ambulatory measures are taken after operation and that sepsis does not occur Small emboli are said to

develop from the stump of the saphenous vein but with a flush ligation this risk is avoided I doubt whether this is a true cause of embolism and the surgeon should not for this reason feel obliged to ligate the saphenous vein too close to the femoral Larger and sometimes fatal emboli may develop after deep vein thrombosis Such a complication should be rare, however provided that the factors causing deep vein thrombosis have been appreciated and immediate treatment is given.

INTERNAL SAPHENOUS VEIN STRIPPING AND AFTERCARE

Having completed the operation of high resection of the internal saphenous vein we now turn to the methods of eradicating the distal varices Of all the methods used that of *stripping* is the one I favour for the average case. The

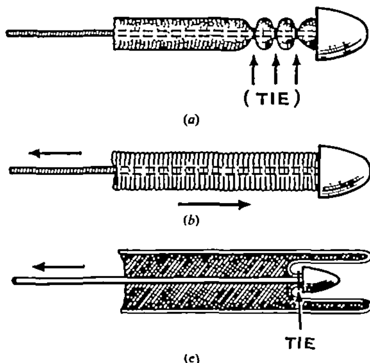


FIG 127 —(*a*) This shows how the vein is secured to the distal end of the stripper This helps the vein to "concertina" on the wire shaft when traction is made (*b*) demonstrates how the vein becomes corrugated against the stripper head at the completion of the operation (*c*) shows the method of stripping in which the vein is made to invert during the stripping process. This method has certain disadvantages.

methods and technique of vein stripping should be studied carefully by those interested in the surgery of varicose veins and for this reason the technique will be described in detail

The following are methods of stripping.

(1) *Intraluminar* method

(*a*) By inversion (or Keller method)

(*b*) By pleating (or "concertina" method)

(2) *Extraluminar* method with a vein stripper of the Mayo type.

(3) Stripping varices subsequent to the individual ligation of the perforating veins.

STRIPPING

There is nothing new about the stripping of varices, since by various methods they have been avulsed since the days of Celsus, and indeed this was the most popular method of attack in the early part of this century At that time both Keller and Babcock were stripping varices by the intraluminar method We have to ask ourselves why these methods were virtually given up subsequently and why during the past few years there has been a world-wide return to this operation The reasons are not difficult for us to appreciate when we realize that at the time when these pioneers were stripping veins they did not have the great advantage of the antecedent operation of the high resection of the internal saphenous vein, which was not introduced until 1916 by Homans In other words, recurrences occurred since branches at the sapheno-femoral junction had not been ligated and



FIG 128 —Mayo's vein stripper

by-passes became evident at this point Again, as discussed on page 31, Keller's method of stripping was to turn the vein inside-out This method of removal caused the vein to break in many instances and thereby caused haematomas and resulting sepsis This fault was appreciated by Babcock who was the first to strip veins by making them pleat themselves against the stripper head However, his type of stripper with a small head frequently caused the vein to invert with the attendant complications already mentioned Again, in those days the valuable help of antibiotics was lacking The result was that there was a mortality to this operation which was not justified when dealing with a condition such as varicose veins However, now that we have so many advantages when we perform this operation there is no doubt that we are able to offer our patients a safe and lasting surgical treatment, which in my opinion is the best at the present time

The methods of stripping varices are many and varied, but they may be divided into two main groups, that of *extraluminar* and *intraluminar stripping*

The *extraluminar method* is usually performed with the Mayo stripper (Fig 128), the vein being threaded into the loop of the instrument and separated from the surrounding tissues In the course of this separation the branches are severed from the main trunk and the vein may then be extracted once it has become mobilized

I never use this method, but always carry a Mayo stripper in my bag Its use as far as I am concerned is confined to the rare occasions when the intraluminar method has produced a "shredding" of the vein without its extraction These torn fragments can be removed with a Mayo stripper, and this will be described later

The *intraluminar methods* of stripping may be further divided into two main headings First, the method of stripping by inverting the vein, has been discussed when referring to the work of Babcock and Keller in 1905 It is shown in Fig 127 (*c*) how the vein is made to turn inside-out as it is pulled

from its surroundings The second method of intraluminar stripping is that which for want of a better word we may call the "*concertina method* Reference to Fig. 127 (*a* and *b*) will show the reader that a stripper with a large head is used, so that when the vein is extracted it is made to plicate itself in the form of a concertina against this head This method has the advantage of seldom breaking the vein in the course of its extraction and is usually a bloodless procedure when performed in the manner which we describe.

The method which I use and which has been referred to as the concertina method is not original A large headed Myers type of stripper causes the vein to concertina in one piece and to be avulsed with all or most of its branches

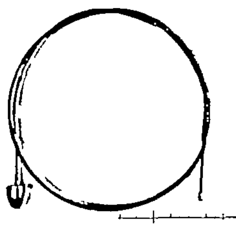


FIG 129 —Myers's vein stripper

I hope that I have been able to incorporate the main good points of technique from all the many surgeons all over the world who have helped me in my research and that the reader will forgive me if I present that which some may feel is an over-detailed description The first film showing this method to be made in Great Britain was produced by the author in 1952 and the first descriptive article in 1953 The method which is so well established now was slow in getting started In any case in the subsequent eight years the method (for which most of the credit should be given to Myers) is now in general use in this country

Intraluminar stripping by the " concertina " method

Selection of patients

It will be found in Chapters 6 and 7 that the indications for surgical treatment have already been discussed. In the main, the stripping operation should be reserved for those who are suffering from a valvular incompetence of the superficial venous system whether in the internal or external saphenous vein There is no doubt that the patient with clear-cut valvular incompetence of the saphenous system has the best outlook for a good result. Patients must be told however that in certain instances, oedema residual varices pigmentation and telangiectases may persist after operation if a previous deep venous thrombosis has damaged either the deep or perforator veins It has already been pointed out how important it is to treat the younger group of patients with thoroughness so that the inevitable sequence

of complications may be avoided Age, however, by itself is not an important factor, since other things being equal there is but little added risk to the elderly patient

Instruments required

On page 122 the reader will find a list of the instruments needed when performing a high resection of the saphenous vein followed by stripping For the average case I have a particular preference for the stripper described by Myers (*see* Fig 129) and this is the one which will be used when details of the operation are given It will be found that it is better to use too large rather than too small a head on the stripper so that no risk of inverting the vein may occur. I have a particular preference for the half-inch head, but use a larger one if the

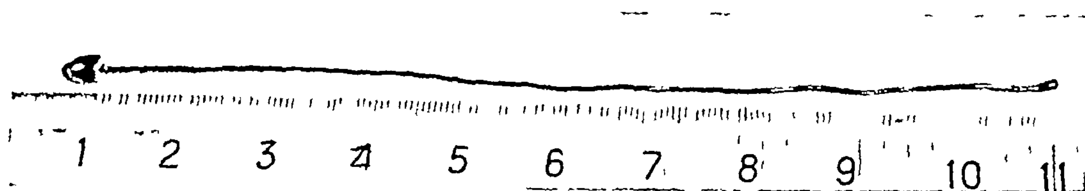


FIG 130 —Silver wire stripper

necessity arises The components of the wire consist of a central core made of a nickel amalgam around which Staybrite wire is tightly coiled The qualities of this wire allow it to be introduced with ease, and it finds its way round the corners in a remarkable manner The head can be enlarged by threading on a washer of appropriate size I have these made cheaply out of plastic and find them of great use All the various modifications of the original Myers stripper head I have found to be of little practical use The very simplicity of the original instrument is one of its most important advantages, and I can see no reason for cups, screws, and varied contraptions being added to it

The silver wire stripper shown in Fig 130 is only used under special circumstances which will be described later

Stripping of the internal saphenous vein

Stages of the operation

First, a careful high resection of the internal saphenous vein is performed as described in pages 123–137 The distal end of the divided internal saphenous vein is then dissected down for a few inches of its course. It is essential during this procedure to divide all branches which are joining it. If this is not done, brisk haemorrhage may occur during the process of stripping in that part of the wound which is unsupported by the tissues

After this portion of the vein has been mobilized, the wound should be covered with a swab A vertical incision is then made over the point marked at the ankle where the saphenous vein passes in front of the internal malleolus In fat patients or where the internal saphenous vein cannot be easily felt at this point it is possible to make a transverse incision of the same length The disadvantage of the latter, however, is that the healing of the wound is less satisfactory. Furthermore, a vertical incision can, if necessary, be extended up or down so as to deal with branches and perforators

When the vein has been exposed the lower end is clamped with a pair of artery forceps, which are rotated in a clockwise direction so as to put the vein on tension and to allow a transverse incision to be made into it without loss of blood (Fig. 131) The lip of the incised vein is then picked up with a pair of fine forceps and the

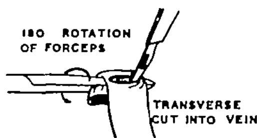


FIG 131 —The method of incising the veins so as to admit the stripper without haemorrhage.



FIG 133 —Insertion of the stripper into the saphenous vein at the ankle.

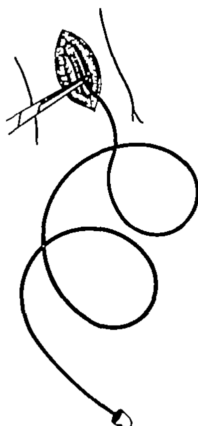


FIG 132 —The insertion of the stripper into the internal saphenous vein at the ankle.



FIG 134 —An alternative method of opening the saphenous vein at the ankle to admit the stripper A small oblique cut will gape easily and provide a small lip to guide the stripper into the lumen of the vein without difficulty

stripper is introduced (*see* Fig. 132) Practice is required to make the stripper run easily up the leg to appear in the groin wound As a rule, if it sticks, its withdrawal and gentle easing past this point will allow it to pass Sometimes it is necessary to flex the knee slightly and to rotate the hip so as to straighten the length of vein which is being entered It should always be remembered that the stripper which is free from kinks and twists will pass more easily than one of the

"corkscrew" variety Rarely is it necessary to incise at the point of obstruction and ease the stripper wire through by sight Once the small end of the stripper arrives in the saphenous vein at the groin the top pair of artery forceps are rotated and a small incision is made to allow the escape of the stripper wire, which is pulled



FIG 135 —A pair of artery forceps with the blades covered with rubber tubing will control any blood loss from the opened upper end of the saphenous vein while the lower end is being attached to the stripper

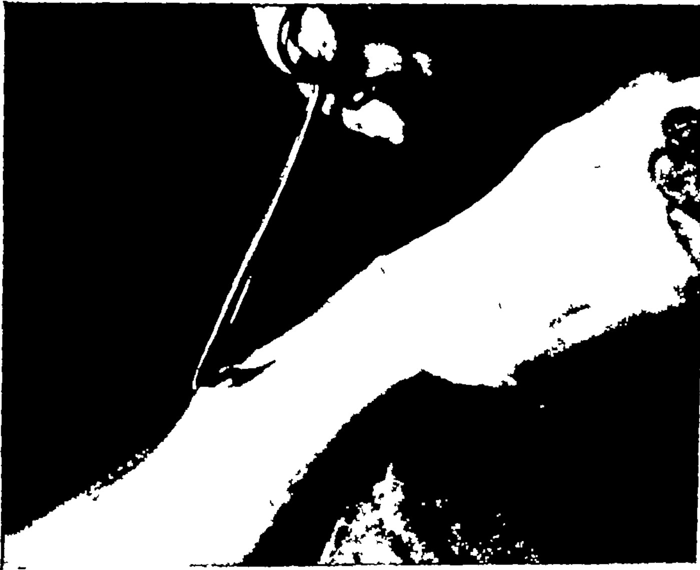


FIG 136 —Elevation of the skin at the upper end of the ankle incision with tissue forceps will facilitate the entry of the large stripper head

upwards until the large knob of the stripper has found its way into the ankle wound The assistant then controls any haemorrhage from the top end of the saphenous vein and allows the operator to tie the head of the stripper into position I now use a pair of artery forceps, the blades of which have been covered with a piece of rubber tubing, to clamp the top end of the vein so as to prevent any leakage of blood while dealing with the lower end

Method of attaching lower end of vein

This is illustrated in Fig. 127 (*a*) and one two or three ligatures may be placed in this position so as to help in the plication of the vein during its extraction The distal end of the saphenous vein in the ankle wound is then divided and the vein is ready for extraction



FIG. 137 —An example of skin dimpling seen during withdrawal of the stripper Note that the assistant is tearing the skin away from the stripper head to aid the attenuation of the tributaries. Note that the ankle incision is already sutured.



FIG 138 —A further example of skin dimpling.

Withdrawal of stripper

A steady but firm pull is then given to the stripper wire and the journey of the head up the leg is closely observed It will be noticed that the stripper passes with ease for a certain length of the leg and then sticks causing a dimpling of the

skin This puckering is caused by the presence of a branch entering the main trunk of the saphenous At this point the assistant pulls the skin away from the stripper head, since by so doing he attenuates and finally ruptures this vessel and allows the head to travel slowly upwards In rare instances, below the knee especially, where a large branch joins the saphenous, very hard traction may become necessary and under these circumstances it is wise to cut down through the puckered skin and to divide the branch which is joining at that point On occasions, when passing the stripper, it may enter a deep vein through a large communicating branch In this case, needless to say, the stripper will not appear

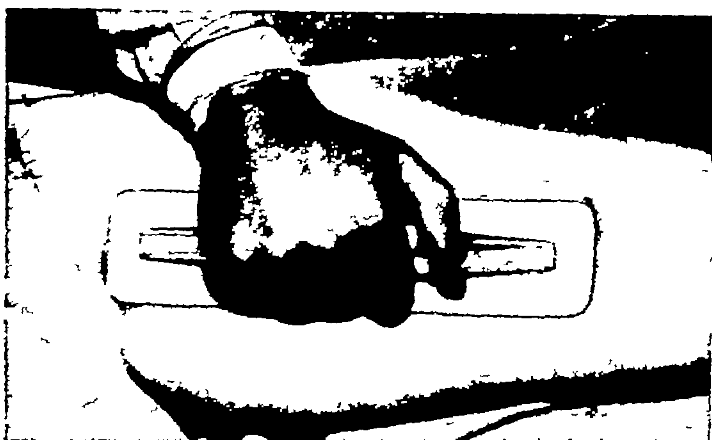


FIG 139 —The compressor being applied to the medial side of the thigh after withdrawal of the stripper Firm pressure must be maintained for five minutes

in the saphenous vein at the thigh incision No damage is done if this occurs, but the operator must be well on his guard to use no force in passing this instrument under such circumstances or he may not only cause damage to the valves of the deep vein, but might be sufficiently unfortunate as to perforate it In a personal communication from Mr O'Malley I am told of a most unpleasant experience he underwent The stripper entered the deep vein in the thigh passing high into the femoral vein In this position it could not be withdrawn. It was necessary to release the stripper by exposing the external iliac vein, where it was found to have been trapped in a small tributary above the inguinal ligament Rough handling would have caused serious damage to the iliac vein This is the only instance I can recall in which the small head of the stripper has been caught The moral is simple Should a similar misfortune occur—*do not use force.* Expose the upper end of the stripper and then free it from above

The operator must remember when extracting the vein that rapidity is not necessary; in fact it is a disadvantage, since the vessels which join the saphenous vein should be stretched like elastic so that when they have become attenuated they will break and retract, thereby minimizing haemorrhage Surgeons who are also fishermen will find no difficulty in the extraction of the vein As in playing a fish, the line is kept taut. No jerks are allowed and steady tension is exerted As soon as the vein has been stripped out of the top wound firm pressure should be given with the flat of the hand to the inside of the thigh

A refinement which I have found to be invaluable over the past few years lies in the use of the " compressor " (Fig 139) at this stage This plastic rectangle



(a)

This limb has been stripped from ankle to groin in the presence of both ulceration and induration. It will be noted that the limb is now free from oedema and the ulcer is healed. The skin covering is poor however and will in due course be improved by skin grafting.



(b)

can be held firmly to the thigh with one hand along the track of the avulsed vein *Five minutes* of firm pressure will prevent haemorrhage and subsequent haematomas and bruising. This method is far better than bandaging, and used in many



Fig 140 —It is always wise to check the length and continuity of the stripped vein The position of any breaks in the vein can be seen and appropriate steps taken if necessary Note the use of the compressor at this stage of the operation.

hundreds of patients has been of the utmost help After five minutes compression the open ends of the avulsed tributaries will have sealed off and no further bleeding will occur If the limb has been fully elevated and careful surgical technique has been used the whole operation may often be completed without the loss of more



Fig 141 —Completed operation. Note placing of incisions.

than a few drops of blood Even so the compressor is of advantage even if only from the cosmetic angle to prevent bruising

A further small point in the control of haemorrhage is for the assistant to suture the ankle incision as soon as the stripper head passes under the skin This single stitch takes but a moment and makes the ankle area clean

Haemorrhage is surprisingly slight, provided the high Trendelenburg position has been used and the extraction has been carried out with care It now only remains to bandage the lower leg firmly from toe to knee and to leave the patient in the tilted-up position for about five minutes

I have explained the stripping of the main trunk of the internal saphenous vein as simply as I can This is usually the easiest part of the operative procedure In

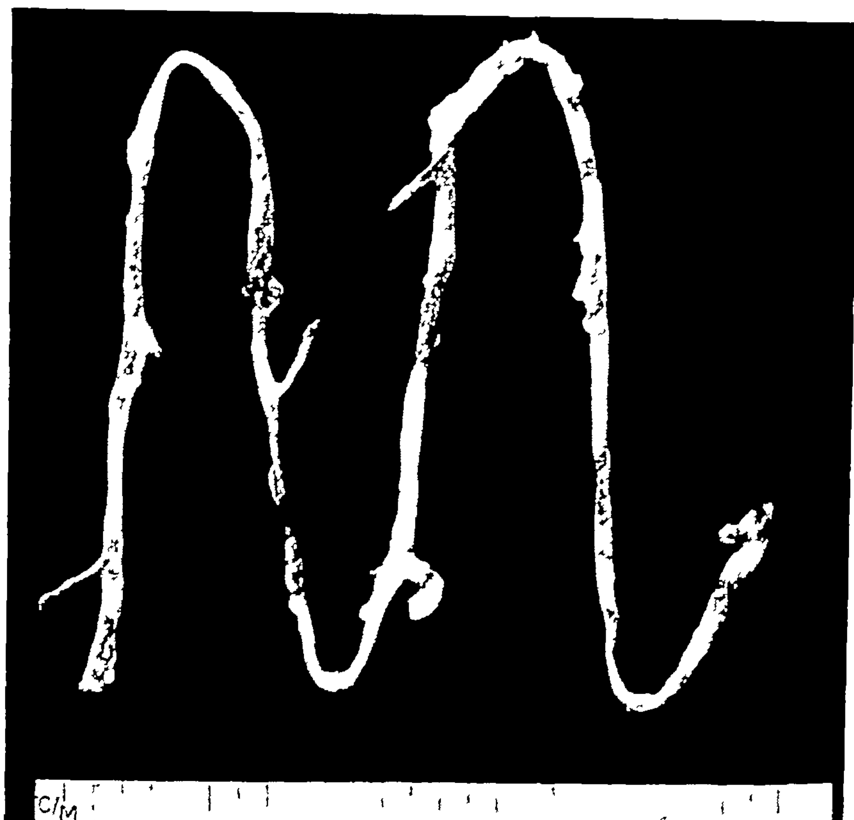


Fig 142 —An internal saphenous vein which has been stripped by the " concertina " method from ankle to groin

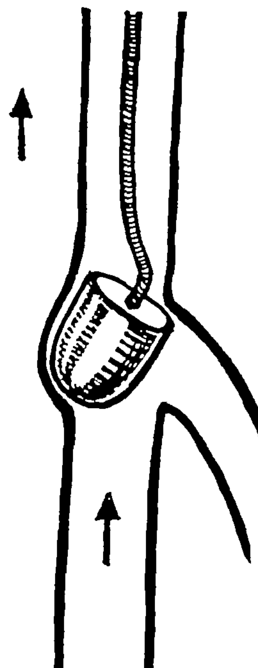


Fig 143 —" Cocking " of the stripper head

many patients this stripping through two small incisions is all that is required In others, however, further incisions are required It is my custom, after clamping the top end of the vein to the stripper wire, to note the branches joining the main trunk, which can now be felt with ease once the stripper wire is within it The joining branches have all been marked with ink prior to operation, and if it is felt that any of them are too large to break off when the stripper head is pulled through, they must be divided locally prior to pulling Failure to do this will cause the stripper head to " cock " (*see* Fig 143) Once the head is in this position the worst can happen In other words, the main trunk can well be split and shredded all the way to its termination This will not only cause haemorrhage, but may make it very difficult to remove the shredded pieces, which as a rule can only be avulsed by using the Mayo extraluminar stripper (Fig 128) All this can be avoided by a careful resection and, if necessary, a local stripping with a small-headed stripper of the branches joining the main trunk Experience only will tell the surgeon which of these joining radicles will not " pull through " Sometimes

when making the steady slow and *firm pull to the stripper* wire a change in resistance will tell you that the main trunk of the vein has started to shred Again if you watch the dimples in the skin in the neighbourhood of the stripper head it can sometimes be seen that this annoyance has occurred. The great thing is to take time over the extraction of the main trunk and not to *pull it out* until all *large* joining branches have been completely resected The joining branch just below the knee is the worst culprit.

Once the main trunk has been avulsed the time has come to deal with the " blow-outs " or incompetent perforating veins It is noted during the withdrawal of the stripper which veins have been dealt with while others will be connected with branches at a distance from the main trunk These latter need excision through small cuts made in the direction of " Langer's lines " Fig 144 shows the typical appearance of such a " blow-out Note the T shape formed by the junction of the perforator with the superficial vein With practice the incision for their removal becomes smaller

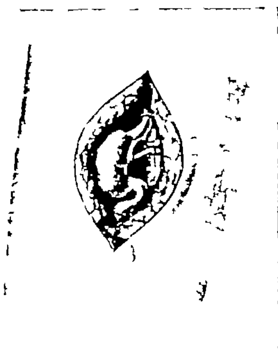


FIG 144 —Exposure of incompetent communicating vein. (*By courtesy of Dr G H Pratt and "Journal of American Medical Association"*)

Immediate after-care

There is considerable divergence of views as to the after-care of the patients who have been submitted to this form of operation. In many clinics the limb is firmly bandaged from toe to groin after operation and, in addition to this, pads of Gamgee tissue are held in place by strapping along the course of the vein In my opinion this is unnecessary and serves to immobilize the limb and so increase the dangers of deep vein thrombosis However it would appear to be admissible, in the rare case of haemorrhage to bandage the limb in this manner for the first few hours after operation.

I adopt the following routine for the majority of patients

(1) The foot of the bed must be raised 12 inches on blocks for the first 12 hours after operation

(2) Ankle and knee movements should be encouraged as soon as the patient is well round from the anaesthetic. These should be gentle and should merely cause a contraction of the muscles

(3) Eight hours after operation the patient should be encouraged to swing his legs over the side of the bed

(4) Codeine and aspirin are usually all that are required for discomfort, since there is surprisingly little pain.

(5) The day after operation short walks every 2 or 3 hours with relaxed are necessary

(6) Discharge from the hospital occurs on the second, third or according to conditions

(7) Stitches are removed on the seventh or eighth day, at which ti are seldom required

(8) Bruising of the leg in the course of the extracted vein may in be extensive, but this causes but little discomfort to the patient and d a week or so

The less immobility in the early stages and the more the patient is to relax the leg muscles when walking, the less discomfort will be e Pain is essentially a cramp and can be avoided by this relaxation advi

The week after the stitches have been removed the patient should the instructions of the surgeon, and I give below the list which I patients after removing their stitches

Post-operative instructions

Now that your stitches have been removed you are well on the way However, you must still be careful There are certain rules which all patie undergone this operation are wise to observe

Your wounds have been covered with plastic skin, and this allows yo bath within three days' time Do not rub the wounds, but if any of them way cover them with Elastoplast dressing strips When applying these d them on loosely so that the air can get underneath Do not be alarmed if a stitch works its way through at a later date Every now and then one of the sutures does come through It does no harm, but do not try to pull it o

You will want to know how much exercise you can take, and the best a give you is to imagine, if you can, that you are 70 years of age for the next In other words, potter about You will not sit in a chair indefinitely, o Just potter about the house, do your shopping or a small amount of busi an hour's exercise, followed by an hour's rest, is the ideal After a week, able to increase your activities

You will be more comfortable if you apply the crêpe bandage from t anyhow for the next few days This bandage should be put on first t morning and removed at night

If you happen to observe a few red patches on the leg or suffer some te not worry, since this only means that a few of the veins which have not be with the stripping are gradually withering away

You cannot expect to get the full benefit of your operation for a fe Furthermore, remember that I have removed all the varicose veins from yo is possible, but I cannot guarantee that new ones will not form in the future happens with a certain number of patients, but it is only fair to warn you For this reason an annual check-up is essential and you must rememb anniversary of your operation, to get into touch with me and make quite see you By doing this you may avoid further surgical treatment

In addition to these few points, always remember to sit when you are a stand as little as possible Remember that exercise benefits the limb As a going up and downstairs contracts the muscles of the calf and drives the bl limb

Finally, I repeat once again, please do not forget your annual check-up leg, and I must depend on *your* memory

Late after-care

It is not always possible to remove all the branches with a single stripping Patients should attend a few weeks after operation, when smaller radicles which have been missed may be injected Larger branches are better excised under local anaesthesia. It is wise to wait a few weeks before doing this, since these branches may disappear spontaneously

Advantages of this form of stripping operation

I feel at present that this is the best method of stripping varices The instruments are simple and the technique is quickly acquired. Haemorrhage is usually slight and with practice the stripping may be made a very complete performance

ALTERNATIVE METHODS OF STRIPPING

Stripping from above downwards

Many surgeons have described a technique advocating the stripping of the internal saphenous vein from the groin wound downwards to the calf I feel that this method although sometimes easier to practise, has the disadvantage of being more frequently associated with haemorrhage and haematomas If the process of avulsion is from ankle to groin the radicles which join the main trunk from below upwards in the limb can be more easily extracted and be caused to attenuate and retract. Even though the extraction or stripping of the vein may be more difficult from below upwards it is still the method of choice.

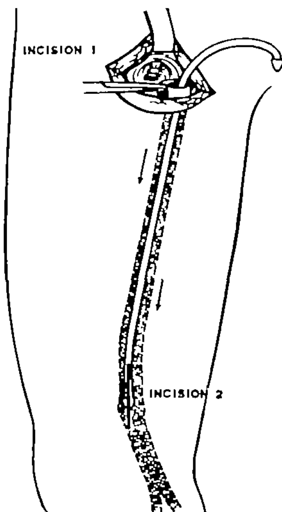


FIG 145 —Stripping the internal saphenous vein from above downwards with a malleable silver wire stripper This piecemeal method of vein stripping is practised by some surgeons and is described in the text. The Myers stripper may also be used

As an example of the controversy over this point it is interesting to read what Webb (1951) has to tell us on the subject. He discusses a modification of the Myers type of stripper Finding that the saphenous vein tended to break when being stripped from below he made this stripper with detachable heads so that the wire might be inserted from the ankle wound and then, after screwing the stripper head in place the vein could be stripped in the retrograde direction. He claims this to be more satisfactory since the upper end of the saphenous vein is of larger calibre than the lower and invagination and subsequent

breaking of the vein were thus avoided. I still feel, however, that the advantages of stripping from below are all-important and that, provided a large enough head is used on the stripper, the difficulties discussed by these authors should not arise. When discussing the stripping of varices in the presence of ulceration, it will be found that in certain cases stripping from above down to just below the knee may be a necessary procedure in order to heal the ulcer. Once this has occurred, stripping from the ankle to the knee can be performed at a later date through healthy tissues. This is the *only* indication for stripping from above downwards as far as I am concerned.

Cases of difficulty

The introduction of the stripper at the ankle may occasionally present difficulties. In such cases the saphenous vein should be exposed below the knee, from which point it is usually possible to pass the stripper first upwards to the groin and then downwards to the ankle. The vein can thus be stripped out in two pieces quite simply. Again, if the stripper sticks at any point after its introduction, it is only necessary to cut down and extract each portion of the vein piecemeal (Fig. 145). The more often one performs this operation, however, the less frequently does it appear necessary to make more than the two incisions, one in the groin and one at the ankle. It may be found that the silver wire stripper is more easy to use for the short pieces of stripping. This malleable silver wire may be bent into any shape required whilst *in situ*, and is useful for piecemeal or serial stripping of large tributaries.

Alternative types of stripper

As previously mentioned, ingenuity has been shown in the development of various types of strippers. The simple Myers type is in one piece, but many operators, such as Fratkin, prefer a detachable button head. Luke of Montreal uses a simple type of stripper, and if he requires a larger base to the head merely threads a tap washer down the shaft. Again, Slemon of Toronto fits a piece of lint to the underside of the head, claiming this to be an advantage in the course of the extraction of the vein.

Cole and Holden (1950) describe a polyethylene rod vein stripper, which causes the inversion of the vein. Again, Zollinger and Gilmore (1952) discuss the use of their stripper, which has a traction cable which is screwed into the distal end of the stripper head. This allows the stripper to be pulled backwards and forwards with a sawing motion. They claim that this allows them to retrieve the stripper in the event of the vein rupturing and assists them in the rupture of branches. This procedure appears somewhat complicated to me and I can still find no faults with the Myers stripper after considerable use. However, the method is ingenious and those interested are recommended to read the article in its entirety.

Webb (1953) describes the use of his stripper, which differs from others inasmuch as the shaft is made of ribbon steel instead of wire. He claims that this makes it possible to insert the stripper more easily. I have used this stripper, but do not like it nearly as much as the original simple type given to us by Myers. In fact, the more cases I operate upon the more simple do my instruments become. With the careful technique along the lines recommended by Myers and modified by myself it will be found that this simplicity of instruments and technique offer us the easiest method of removing the varices from the limb.

The use of two strippers at the same time (*see* Fig 146)

When faced with a double saphenous vein, the use of two strippers at the same time is sometimes an advantage As a rule, the extra saphenous is a much enlarged accessory vein Under these conditions, after passing the stripper from ankle to groin in the usual way, a second stripper may, with advantage, be passed upwards along the enlarged accessory. One pull produces the double saphenous as shown



FIG 146—This picture demonstrates the use of two strippers in the removal of a double internal saphenous vein. As explained in the text, we sometimes use this method of stripping the two main trunks at the same time

A further use of two strippers at the same time may occur as follows If the stripper which has been inserted from the ankle sticks, say at knee level, a second stripper may be passed from above to the obstructed point One incision at the point of obstruction will then allow the two strippers to be pulled up and down from this position The advantage in this method lies in the fact that the strippers are more easily passed before section of the vein at the point of obstruction

Summary

(1) The intraluminar method of stripping is by far the most satisfactory

(2) The simplest instruments are best The advantages of the Myers stripper are described

(3) The manoeuvre of stripping should be performed *slowly* Speed does not allow the branches to become attenuated before rupture

(4) Preliminary division of *large* joining tributaries will prevent shredding or rupture of the main trunk being stripped

(5) Emphasis is laid on the prevention of haematoma formation by elevation of the limb, immediate pressure after stripping, and firm bandaging of the lower leg

(6) The importance of early post-operative mobilization in the prevention of deep venous thrombosis is stressed

SPECIAL CASES

Stripping in the presence of ulceration

The presence of ulceration is not a contra-indication to stripping (*see* Plate V, *a*) Whenever possible, however, it is advisable first to get rid of the induration and oedema This may mean prolonged supportive treatment with a possible period in bed prior to surgery Every case has to be judged on its merits, but provided gross sepsis is removed from the ulcer area there is no risk in stripping the varices above As previously mentioned, this is one of the occasions when, after a careful high resection operation, the internal saphenous vein may be avulsed from above downwards As a rule, this is quite easy to do in one piece to just

below the knee In some cases the internal saphenous vein is sufficiently large below the internal malleolus on the *dorsum of the foot* to admit the introduction of the stripper which may in most cases be pulled through the indurated tissue without causing any trouble At the time of stripping, the ulcer may be skin grafted if it is thought to be necessary It should be noted that the late results of a combined form of stripping, skin grafting and careful elastic compression are still dependent to some extent on the future activities of the patient. In cases of ulceration which are healed by these measures the patient will have to be careful regarding the length of time he stands and he may have to change his occupation Again he will have to be careful as far as foot hygiene is concerned and when necessary continue with elastic support for his leg

I repeat that it is far better to get the patient, as well as the leg fit for surgery before stripping Most of these patients require weight reduction and during that period massage and compression will heal the vast majority of ulcers and render the tissues soft and supple and make them ready for safe stripping The type of patient who will not carry out these preparations for operation is unlikely to follow the régime necessary after surgical interference It is surprising how many patients who have suffered from stenching ulcers for years expect the limb to be put right within a few days However the majority if the whole situation is explained to them carefully will eventually co-operate and give us the opportunity of offering to them safe surgery "

The patient with bilateral varices

Generally speaking it is better to attend to each leg separately The safety of any operation such as stripping is dependent on the early ambulation of the patient and if both legs are operated on at the same time many patients may find difficulty in walking in the early stages of their convalescence However every case must be considered on its merits and there are occasions when the stripping of both legs at the same operation is fully justified. Such treatment however should essentially be reserved for the younger and more active type of patient whose operation is not going to be of too lengthy a nature As explained elsewhere teamwork in this operation has altered our views considerably particularly regarding the bilateral operation A highly competent assistant can cut down the time the patient is on the table very considerably The two operators do not try to operate on a leg each at the same time since this leads to confusion The assistant can always be sewing up wounds whilst the surgeon is carrying on the operation elsewhere with the help of the theatre sister There is no doubt that those of us who confine our surgery entirely to varices are able to develop a team consisting of assistant, theatre sister and anaesthetist who working with each other all the time, can cover more ground than was ever before thought possible However for the general surgeon who is only dealing with varices occasionally one leg at a time is the safest advice These points are discussed under Planning the Operation on pages 112–116 and each patient presents a different problem If both limbs are the seat of incompetence of both the internal and external saphenous veins and if in addition we are faced with multiple incompetent communicating veins and perforators it is not wise to attempt to deal with the whole situation at one operation. Judgment and experience are required in the advance planning of such an operation

Surgical treatment in the presence of superficial thrombophlebitis

Acute superficial phlebitis should, whenever possible, be treated by an immediate high resection of the internal saphenous vein This will cause a subsidence of the condition usually within 48 hours This surgical emergency cannot be performed if the top inch or two of the main trunk of the internal saphenous vein has become thrombosed For this reason early attention is essential The surgical treatment should be given in combination with antibiotics At a later date, when the inflammation has subsided, the varices may be stripped from below by the method described on pages 140–147

I have had no experience of stripping varices in the presence of acute superficial thrombophlebitis, although there are some who advocate this procedure It would be wrong to criticize a technique about which one is ignorant, but performance of this operation at such a time must surely add to the risks

I note that Myers is prepared to strip limbs three to four days after the superficial thrombophlebitis has subsided Again, I do not agree with this method, since the high resection operation performed, often under local anaesthetic, makes the patient safe and allows the phlebitis to settle down I then prefer to wait several months before passing the stripper In fact, one may be able to wait several years, since Nature has improved the condition of the varices so thoroughly by means of thrombosis that a recurrence of incompetency may be delayed for many years, and this obviously is to the advantage of the patient if we can delay the strip until the time when it is essential

Vulval varices

Vulval varices may occur during pregnancy and require no treatment beyond soothing applications for the pruritus which so often accompanies them These varicosities may also be collateral veins which have developed as a result of a prior thrombosis of the ilio-femoral vein Again treatment is not needed unless made essential either by haemorrhage, pruritus or the very large size of the varices Rest in bed and the application of a firm pad is then all that is usually necessary Sclerosant treatment is difficult to give, frequently painful and is certainly not lasting in its results. It is only fair to state, however, that this is only my own view and is not agreed upon by some surgeons As an example, Solomons (1950) is a firm advocate of the injection treatment of these patients and, in a large series, claims that there is a rapid relief of symptoms after sclerosant treatment He states that he had never encountered any sloughing or cellulitis in one series of 74 cases It is only reasonable to show both sides of the picture, but I still maintain that the close proximity of the internal and external pudendal veins to the femoral vein, and the fact that valves are lacking in these veins, adds a further risk in the use of sclerosants Again, the vulva is a difficult area to sterilize and the mucous covering of these vulval veins may well break down after sclerosis and cause sloughing However, it is of great interest to read Solomons s article and it is recommended to those who would like to follow his technique Dodd and Payling Wright (1959) advocate extensive surgery during pregnancy up to the end of the seventh month in all severe cases which have not reacted to other measures They published the results of the surgical treatment of 80 patients After a high resection of the internal saphenous vein, they open the foramen ovale and inspect the femoral vein, especially its medial aspect, in order to ligate the

deep external pudic vein After this the upper flap of the wound is reflected in order to expose the external oblique muscle and the external abdominal ring They then split the external oblique aponeurosis from the apex of the external ring to beyond the internal ring In their own words they then reflect the two leaves of the external oblique generously The varices are then dissected out



FIG 147—Varicose veins of the vulva Sclerosant treatment is disappointing in these cases which are frequently relieved by ligation of the superficial external pudic vein in the course of a high resection operation on the internal saphenous vein

Good results are claimed by this surgical approach but in a very long experience I have never had to advise such treatment and still feel that it is better to wait until after parturition before considering surgery As a rule at this time it will be found to be quite unnecessary

Varices associated with pregnancy

The treatment of varicose veins during pregnancy is a most controversial subject, but it is one on which I have made up my mind and that is that the majority should be given the benefit of conservative treatment only To quote but one of the many opposite opinions however we have but to read what Dodd (1949) advises. As a result of twenty operations, he advocates that patients up to the seventh month of pregnancy should be submitted to operation if found to be suffering from severe varices. Care is recommended in the choice of non toxic sclerosants and the results of operation were all satisfactory Again in 1956 he advises surgical treatment stating If the mother is fit and the pregnancy

between the third and sixth months, full sapheno-femoral ligation and stripping is the best "

I am unable to agree with this advice Varices, as previously stated, usually subside in a most remarkable manner after parturition. The trials of a pregnant woman should not be increased, nor should the risks of avoidable abortion In my view there are certain exceptions which may call for operation during the early months of pregnancy and they may be summarized as follows

(1) A past history of repeated attacks of superficial thrombophlebitis
(2) The presence of superficial thrombophlebitis
(3) A pre-ulcerative condition of the lower leg which fails to respond to supportive compression treatment

At about the same time in the United States of America we find Hamilton *et al* (1949) supporting the same views as does Dodd They felt that the post-partum thrombophlebitis risks were reduced by active measures directed towards the varices during pregnancy Again, I do not agree

In spite of these writings I feel that conservatism is preferable It is of interest to note that Ambroïse Paré was of the same opinion in 1579 Mendelsohn (1951), in an excellent article, summarizes the varied present-day attitudes towards this subject and gives a comprehensive review of the recent literature

EXTERNAL SAPHENOUS VEIN STRIPPING AND AFTERCARE*

The surgery of the external saphenous vein is, in the main, similar to that of the internal saphenous vein, in other words, a high resection of the main channel in combination with stripping The difference in technique is quite definite, however

It is easier and better to pass the stripper from the ankle *before* performing the high resection, this being the opposite to the procedure with the internal saphenous vein

My reasons for strongly advocating this approach are as follows It is admitted that only half the external saphenous veins join the popliteal vein in the popliteal fossa The remainder may end anywhere in the leg, some in mid-calf and some in mid-thigh

For this reason the stripper passed from the ankle will act as a reliable guide to the path of the external saphenous vein If the stripper wire is difficult to feel behind the knee where it becomes subfascial, flex the limb and it will become obvious

I have found that over the years the surgery of the external saphenous vein is more apt to lead to recurrences than is that of its brother, the internal saphenous vein This is due to the varied termination of this vein, and to the most variable connexions both with the internal saphenous vein and the perforators However, if the external saphenous vein is *stripped in conjunction* with the internal saphenous vein, and its termination is sought with care, prognosis as far as recurrence is concerned is, in any case, moderate

* Owing to the varied termination of the external saphenous vein, this operation *is in no way standard* Reference to the various anatomical endings of this vein demonstrated in Fig 58 makes this point clear Termination of this vein is deep to the deep fascia

Carroll (1949) states that in a series of 515 operations only 10 per cent of the patients showed incompetence of the external saphenous vein This statement has found its way into many writings I am now quite satisfied however that a far larger number of external saphenous veins are involved in varicose limbs than this figure suggests Careful examination makes me realize that the number in



FIG 148 —The right leg shows severe varicose involvement of the external saphenous vein. The internal saphenous vein appears to be healthy The left leg is the seat of "athletic veins" It has been noted by the author that involvement of the external saphenous vein is more common in the male than in the female.

my clinics is nearer 50 per cent I agree that sometimes the external saphenous vein becomes less obvious after the internal saphenous vein has been resected this being due to the communication between the two systems Even so I am stripping far more external saphenous veins at the time of dealing with the internal saphenous veins I would ask the reader to make quite certain before operation that the external saphenous vein be carefully examined *with the knee bent* I think he will then find that he will be stripping far more of these short saphenous veins

The *position* of the patient is important He should be lying on his face with ankles extending over the end of the table This relaxed position of the ankle joint is important to help the surgeon to expose the external saphenous vein *just* external to the outer border of the tendo achillis The vein is easily exposed with a vertical incision, and its relationship to the nerve is shown in Fig 175

A vertical incision can be extended either upwards, or more often, downwards in order to deal with joining branches, and with the all-important *blow-outs so*



Fig 149—A venous pattern of common interest The left leg shows massive involvement of the internal saphenous vein The right leg shows a severely varicosed external saphenous vein in which the main trunk has been deflected to behind the *internal* malleolus This is not an uncommon finding but must be noted before stripping

commonly found just below the external malleolus Also, this incision heals so much better than does a transverse cut

Having exposed the vein, the routine of passing the stripper into the lumen is exactly similar to that described for the internal saphenous vein (*see* Figs 131, 134) The stripper passes in most cases with ease to the sapheno-popliteal junction, but as previously explained, the external saphenous vein is variable in its termination, and may finish either above or below this point If the wire is difficult to feel, flexing the knee will make it obvious

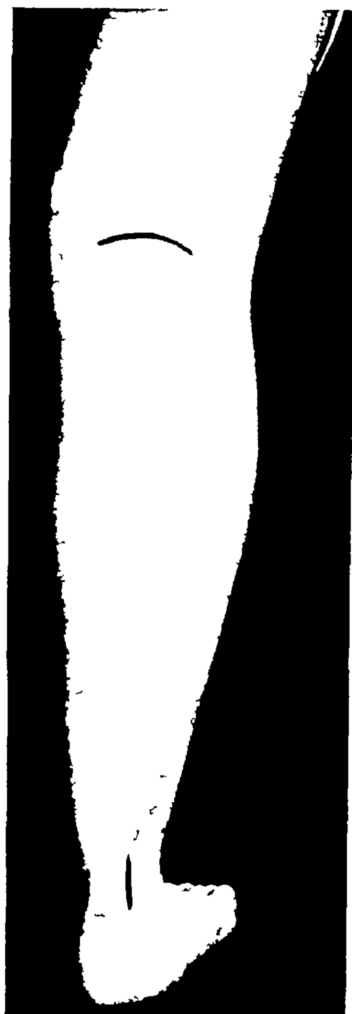


FIG 150.—Position of patient on operating table for external saphenous stripping. Note that the feet should extend beyond the end of the table

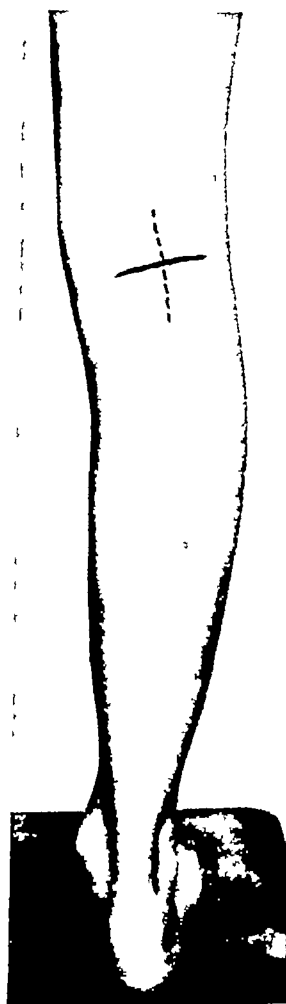


FIG 151.—Method of towelling the limb for stripping the external saphenous vein The whole area of the popliteal fossa must be exposed.

Various incisions can be made behind the knee—vertical, transverse or "inverted thyroid" types (Figs 152, 153) I feel that the vertical incision should never be made Bad healing is common and contracture may occur The ideal exposure is obtained through the "inverted thyroid" incision After making this the vein with the wire *in situ* will be felt deep to the fascia, and needs exposure with sharp dissection To pick the vein up with the wire *in situ* a pair of tissue forceps is the most satisfactory instrument, since it will encircle the wire At this stage,



Left—
FIG 152—Photograph marked to show the usual incisions used when stripping the external saphenous vein The lower vertical incision lies ½ in lateral to the outer edge or the tendo achillis The upper incision is of the "inverted thyroid" type favoured by the author



Right—
FIG 153—Alternative incisions for stripping the external saphenous vein We never use the vertical incision since the healing of the scar is never good A transverse incision which is used by some surgeons does not, in our opinion, give the same excellent exposure as does the "inverted thyroid" incision, as shown in Fig 152

the stripper is withdrawn for an inch and the vein clamped and divided After this, the procedure is similar to the high resection of the internal saphenous vein In other words, the stripper wire is drawn upwards and clamped with the "rubber clamp" (*see* Fig 135), the head being then tied to the lower end of the vein which is then divided The stripping procedure is the same as for the internal saphenous vein, and here again the compressor is of the greatest value During this time of compression, the upper end is gently peeled upwards using a "Lahey swab" All joining branches are resected, and the stump of the external saphenous vein is firmly tied close to its junction A transfixing suture is used for additional safety

The top wound is closed with a few sutures to the deep fascia and interrupted mattress suturing to the skin I prefer to use Whitehead's varnish for the wounds before turning the patient over, in the event of further operation to the internal

saphenous vein I prefer this well tried varnish to all the plastic sprays which are now on the market.

Descriptive writing of an operation is never satisfactory The reader must "see it done" and failing that, study all the diagrams at the end of this chapter Never look upon the operation as being of a minor character There is more responsibility in operating in cold blood on a non lethal condition than in doing a much larger operation on a bad risk such as advanced cancer

At the end of this chapter on surgery of the communicating veins I append a series of diagrams which may be looked upon as a strip cartoon These drawings are to help the student and house surgeon and needless to say are too elementary for the experienced surgeon who may omit reading pages 171–182

THE SURGERY OF THE INCOMPETENT COMMUNICATING VEINS

In the chapter on anatomy (Chapter 3) we have suggested that the term "communicating veins should be used when referring to the direct communications between the main trunks of the superficial system with the deep veins I prefer to use the term "perforators when the communication is between *branches* of the superficial system with the veins which are deep to the muscles.

When stripping the internal saphenous vein, the main communicators such as those that occur in Hunter's canal and just below the knee are usually dealt with by this procedure and require no local removal All perforators and communicating veins not in direct association with the main trunks are not dealt with by stripping, and need to be excised separately

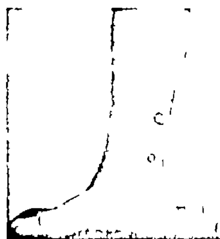


FIG. 154—Marking of perforating veins pre-operatively

The main positions of the perforators are depicted in Fig 49 and when the patient's legs are being marked prior to operation careful palpation will demonstrate the small holes in the deep fascia through which these perforators emerge These are marked with circles as in Fig 154 and a good time for excising them is during that period after the stripping when pressure is being kept on the thigh for 5 minutes prior to suturing the wounds

Extensive operations are advised by Linton (1949) and Cockett (1956) for dealing with these perforating veins Linton's original sub-fascial operation is advocated by Cockett, and those interested should read his articles on the subject

It is to Robert Linton of Boston that we are indebted for the original thought behind the sub-fascial operation on deep communicating veins His pioneer work has done much to elucidate the important role which the perforating veins play when diseased, in the production of the post thrombotic syndrome

In Great Britain the operation has been taken up enthusiastically by Cockett, who has made it the subject of several thoughtful and descriptive papers

As I have said frequently in the past I do not use this operative approach myself It involves a radical anatomical dissection which becomes unnecessary as soon as the limb has been made slim Once this state has been attained by

energetic physiotherapy and properly applied elastic compression
extra-fascial ligation of individual perforators is all that is required
simply performed through small incisions and requires no prolonged
for the patient

In our hands, the results of this simple procedure are just as g(
obtained by the massive sub-fascial operation, which may incapacitat
for months and lay him open to risks which can be avoided by our i
vative approach

Judging from recent writings it is interesting to note that the
thusiasm for Linton's operation in this country, following the work
would appear to be pass
more conservative appro;
have advocated is being a(
widely

I repeat, that after 37
devoted to the varicose f
yet to meet the indurated
after being efficiently s

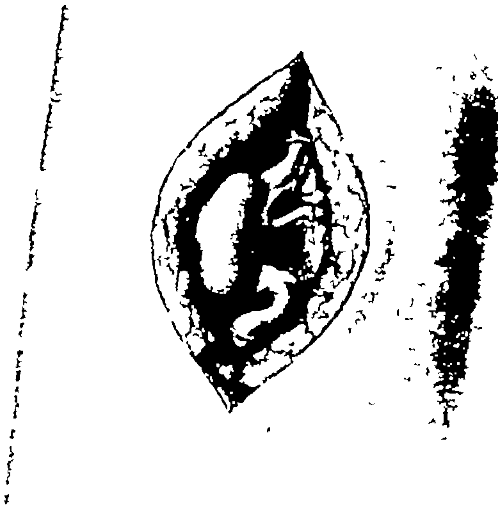


FIG 155 —A typical "blow-
ing the sites for resection (*B*
Dr G H Pratt and Journal
Medical Association)

physiotherapy and compr(
ment, cannot be dealt w
minor procedures which
discuss later

In my opinion it is nc
cut into indurated tissuc
compression with the rig
bandages, together with
massage will normally get a limb into a safe condition for surgery Sm
made carefully in Langer's lines directly over the blow-out can, if n(
performed under local anaesthesia, and do not interfere with ambulati

Fig 155 represents a type of blow-out Here it will be seen that th(
forms a T-junction with the superficial vein, and above the T the vein i
to form that which we refer to colloquially as a "blow-out" Resec(
three veins forming the T, and if necessary, a suture to the hole in the 1
I find to be necessary

When dealing with blow-outs around the internal malleolus, a sr
incision behind the tibia normally allows for the removal of the blow-
area This incision can in some cases be extended upwards if many bl(
present, but here again it is often better to make two or three smal
Hence the importance of careful marking of the exact position of eac
prior to operation

All surgical treatment should be carried out with the patient in the
burg position, since if one of these blow-outs is accidentally ruptured, ha

may be considerable Again, firm compression should be given after suture by means of gauze pads firmly held in position by means of Elastoplast Under no *circumstances must a haematoma* be allowed to occur

I know that this conservative approach to the handling of blow-outs does not find favour with some surgeons at the moment since they prefer radical measures I can but repeat that after very many years experience I find the results to be better with certainly less trouble to the patient if this method is adopted Already at the time of writing I find that certain surgeons who were enthusiastic regarding the Linton type of operation (Fig. 156) are reverting to the more simple measures which I have described In other words perforators can be dealt with by an

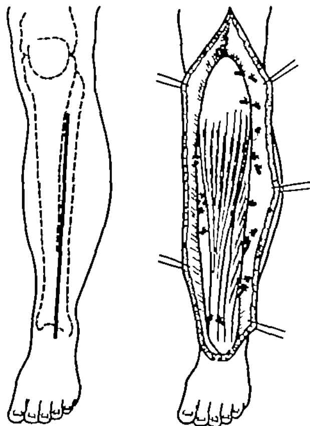


Fig 156 —Linton s operation. The ligation of multiple incompetent communicating veins (anterior group)

extra fascial approach and the massive sub-fascial operation should at any rate only be reserved for the very exceptional case which I have yet to meet. I hope the reader will take note of this and always persist with physiotherapy until his operative field is soft, aseptic and free from oedema.

For those interested in the sub-fascial operation I append original pictures of the Linton Cockett technique in Chapter 17 These pictures should be self explanatory Further details can be obtained by reading Cockett s excellent article

It is I think, a measure of Robert Linton s great generosity that he should allow me to reproduce his original drawings in this book even though he is fully aware of my disagreement with the sub-fascial operation. I am deeply grateful to him for the honour which he has done me

The complications of stripping

The complications of the high resection operation have already been discussed, but there are some which are peculiar to stripping

Haemorrhage

Haemorrhage may occur, but it is easy to control by elevating the limb and applying pressure It is unwise to bandage the limb above the knee for any length of time, since by so doing the limb is immobilized, thus adding to the risks of deep vein thrombosis Temporary thigh bandaging may be necessary for an hour, however With careful technique bleeding can be kept to the very minimum in the operation of stripping In other words, we operate on limbs which have been completely emptied by the high Trendelenburg position We strip the vein very slowly so as to attenuate the branches and minimize haemorrhage Furthermore, we use the plastic compressor (*see* Fig 111) for at least five minutes to the thigh area, after the extraction of the vein It is possible in the majority of cases to operate and find that only one swab has been used throughout the entire operation

Sepsis

This should be a rare complication, but having regard to the fact that the tissues are subjected to trauma, antibiotics are used as a routine for the first two or three days in all cases showing ulceration or a septic operating field

Deep vein thrombosis

The risks of this condition are less than when large doses of sclerosants are used It does occur, however, and as an example, in a personal communication (1959) Warren of West Roxbury states that in the course of 300 stripping operations there was but one case of deep vein thrombosis, which settled down under treatment Recently I had a case of severe deep vein thrombosis after stripping, but it was found that this patient had been completely immobile for four days after operation Subject to there being reliable teamwork over these operations and the after-care being carefully supervised, deep vein thrombosis is a rarity

The condition which may be mistaken for deep vein thrombosis may occur in the convalescent period after stripping In other words, we may have a reactionary oedema whilst the patient has a normal pulse and temperature, and no other signs of deep vein thrombosis This oedema is usually due to the patient walking too much shortly after operation, or alternatively, to walking with the bandages not sufficiently firmly applied The treatment of these patients consists in using the dry elastic bandage and limiting the amount of exercise, which should be confined, for a few days, to active movements in bed Tenderness in the calf on pressure is a sign which may well be misleading since it will be found that deep pressure, even in the normal leg, can be quite unpleasant True calf tenderness as it occurs in deep vein thrombosis is, however, quite a painful episode The chart is the most reliable guide in separating true deep vein thrombosis from this reactionary oedema, which may result either from an overloaded deep venous system, or from a thrombophlebitis of the veins which have evaded stripping The question of deep vein thrombosis is considered in more detail in Chapter 14, but in passing it is interesting for us to realize that this complication is no more frequent in operations upon the superficial varices than in other surgical procedures

Passage of the stripper into deep veins

It is not uncommon for the stripper to enter the deep veins through large incompetent communicating veins For this reason force should never be used when pushing the stripper up the saphenous vein When dealing with the internal saphenous vein the commonest point for the stripper to enter the deep system is through the mid Hunter blow-out

Inversion of the vein

If the stripper head is too small, we may well remove the vein inside out just as Babcock performed the operation fifty years ago This fault can be avoided by enlarging the stripper head by the addition of a washer in cases where the large lumen of the varix warrants such a precaution

Shredding the main trunk of the saphenous vein

Lack of attention to the proper technique of stripping may cause this unfortunate complication, which consists of the splitting of the vein in most of its length without its removal This is a most unfortunate occurrence, and is occasioned by the head of the stripper cocking " when it reaches the junction of a large branch with the main trunk (*see* Fig. 143) The way to avoid this complication is to divide any very large branch at its junction with the main trunk after the stripper wire is in situ Again as the stripper head ascends in the limb if excessive dimpling of the skin occurs and excessive pulling seems to be necessary it is at this time that a small incision should be made over the joining branch so as to release the stripper head on its upward path

If the surgeon is unlucky enough to shred the vein in its entire length he can but remove it by means of extra luminar stripping, using the Mayo stripper For this reason I always carry one of these instruments in my bag, although fortunately it is seldom if ever required

Summary

Recently we have found a much better method for removing the shredded trunks of either the internal or external saphenous veins Even though the vein is completely split the Myers stripper can be passed down the *track* of the vein in its entire length the head of the stripper being tied to the top end of the vein and extracted in the usual way This very obvious method is less traumatic than using the Mayo stripper and we cannot understand why we did not think of this before To leave the shredded veins in situ not only causes post-operative pain but also allows re-canalization to occur at a later date

Breakage of the stripper wire

This is an uncommon occurrence, but if it happens one has to cut down on to the head of the stripper remove it, and do serial stripping with another instrument Recently in the report of the Medical Defence Union (1957) there was a case where the broken stripper had been left in the patient s leg for eighteen months!

Pain

Pain should not occur after a careful stripping operation provided that early relaxed movements are made by the patient as soon as he recovers from the anaesthetic I emphasize that these movements should be performed in a relaxed

manner, otherwise cramp will occur, and nothing can be more painful It is my custom to teach the patient *before* operation the types of movement and exercises to be performed in the recovery period Another cause of post-operative pain I have noted is in those patients who have been immobilized after operation either by excessive thigh bandaging or splinting Neither of these procedures is necessary if our technique is adopted

Neuritis

It is not uncommon for the saphenous and sural nerves to be damaged during the stripping operation Resultant tingling sensations may occur, which usually settle down after a week or two Small patches of anaesthesia, however, may persist for many months, and it is necessary to reassure the patient about this.

END RESULTS OF THE SURGICAL STRIPPING OF VARICES

An accurate assessment of the end results of the stripping of varices is very hard to obtain I have had the advantage of visiting clinics in many parts of the world and of observing at first hand the results obtained in them over a number of years Owing to the varied methods of stripping, these results are essentially only partly accurate Before quoting the results of others it is as well to state that I am more satisfied by the results I have obtained by the method I have described than by any other I have practised in the past Even so, owing to the progressive nature of the disease it is essential that every patient should receive an annual check-up, and an over-optimistic prognosis should never be given

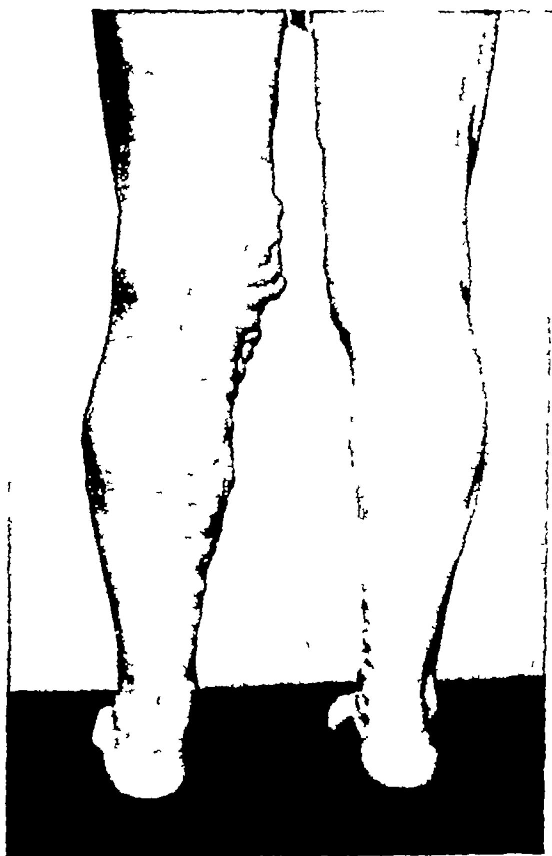


FIG 157 —The right leg, before operation, was more severely affected than the left This photograph taken 2 months after operation on the right leg serves to show the rapid resolution of the oedema and the disappearance of the varices The improvement in the health of the skin and of the subcutaneous tissues follows very rapidly after a thorough operation

Very few follow-up investigations appear to be carried out to assess the efficacy of the stripping operation No one who has personally seen the results of stripping can have any doubt that it is the most efficient operation yet devised A paper by Lofgren, Ribisi and Myers (1958) quotes the following satisfactory comparison between the effects of high ligation and retrograde injection and the stripping operation

"In a comparison of the follow up results obtained in a group of 200 patients who underwent high ligation for varicose veins with the results obtained in a group of 200 patients who underwent a complete-stripping operation, the following observations were made



BILATERAL VARICOSE VEINS—BEFORE OPERATION

FIG 158—A severe case showing bilateral involvement of the internal saphenous vein.



BILATERAL VARICOSE VEINS—ONE YEAR POST-OPERATIVELY

FIG 159—The same patient one year after stripping the varices. It will be noted from the scars that many local excisions of large branches were performed.

1 Of 140 limbs examined five years or more after high ligation 40 / were classified as having excellent or good results, 5 / fair results, and 55 / poor results.

2 Of 128 limbs examined five years or more after complete stripping, 94 / were classified as having excellent or good results, 6 / as having fair results, and none as having poor results.

3 The incidence of recurrence requiring further surgical treatment was 36 / for the limbs subjected to high ligation whereas it was zero for the limbs subjected to

complete stripping Recanalization of injected superficial veins and the presence of persistent perforating veins were important factors in the high recurrence rate after high ligation

These results are convincing evidence of the superiority of complete stripping over high ligation in the surgical treatment of varicose veins "

McPheeters (1956) writes in the support of the stripping operation of varices that " time and time alone will give the best and most conclusive answer to all questions relative to the value of any method of treatment in the field of medicine It is the checking up of our work and end results from year to year that finally permits us to say with conviction, 'this is the best method of treatment today'"



FIG 160 —Moderate internal saphenous varicosities with large perforating vein



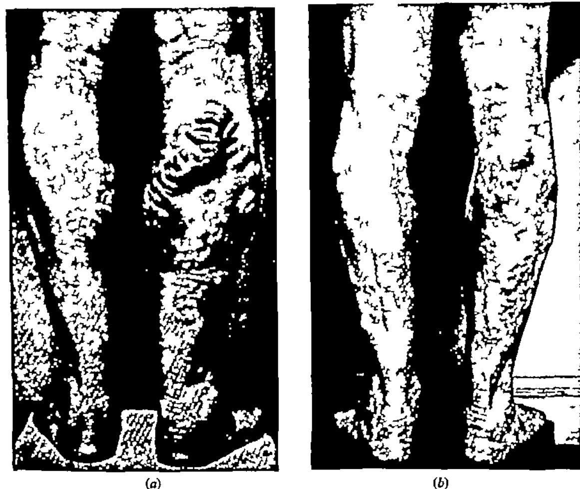
FIG 161 —The same case three months after operation

We must all agree with these wise remarks of McPheeters, and realize how very little help the varied statistics are to us Our view may vary as to the definition of a perfect or, alternatively, bad result

I am frequently asked to produce statistics of my own series of strippings, chiefly because I do nothing else, my list is a long one and many patients have now reached the ninth year since operation I can find no really fair way of placing these results in pigeon-holes I will say, however, that 95 per cent are benefited Gross recurrence is to be seen in about 5 per cent These are the ones we remember! Usually such recurrence is our own fault A double saphenous has been missed, perforators have escaped our attention, or the external saphenous vein has eluded stripping The more thorough we are at the original operation the better the outlook The collaterals and the entire superficial venous pattern must be destroyed

The younger the patient the worse the prognosis at least, that is my experience The varix seems most active in youth and the legs are usually dependent for longer periods Also there is more time in youth for a recurrence to appear since many of our elderly successes die before they have established a long period of recovery

Since I follow the technique of Myers I feel that his statistics should receive especial consideration—in other words 94 per cent excellent results in a series of



(a) (b)

FIG 162.—(a) Severe varices associated with oedema in an elderly man of poor physique. This patient was treated by means of high resection of the internal saphenous vein together with local excisions and ligations of his varices (b) the end result 9 months later is satisfactory since the oedema is controlled. However light support by means of stockings is advisable in his case.

2,660 patients followed up from two to five years (Myers 1957) To show how variable the statistics are of patients subjected to varied techniques of stripping, I herewith mention a few results of contemporary surgeons

Dulin (1949) describes a method of retrograde stripping downwards from the groin using a silver wire stripper and in a series of cases in a two-year period ending in 1948 claims a great improvement in 66 per cent, moderate improvement in 24 per cent, with poor results in 10 per cent. He had no operative mortality and noted that the best results were obtained in the younger age group Sullivan

and Merdinger (1951) discuss their interesting comparative findings in a series of 174 cases of severe varices, of which 102 were treated by stripping and 72 by means of multiple ligation One year after operation 94 per cent of the stripped legs showed either excellent or good results in comparison with 13 of those treated by multiple ligations These figures certainly support the former operation very strongly, even though the follow-up was only over a short period

In an excellent article by Vaughn *et al* (1952) 150 cases of vein stripping are discussed and after a four-year period they state that this method appears to be the most effective up to date The technique employed was retrograde stripping with a modification of the Linton stripper Linton (1949) gives us the statistics that in a series of 500 patients there was no death and only one case of deep thrombosis His method was to use a wire stripper and to strip the veins in a retrograde direction, making several incisions in the leg The author has had the opportunity of seeing some of his end results, which were most satisfactory

Zaidman, Vilanova and Pataro (1954) report that the stripping of 1,219 extremities proved safe and successful They found stripping to be an improvement on other methods and found recurrences to be far less

Fenney (1951) discusses the results he has obtained in stripping 149 limbs This series treated by stripping and ligation showed an 86 per cent excellent or good result, with a 14 per cent fair or poor result It is of interest at this point to note that with ligation and intraluminar stripping, Hodge, Grimson and Schiebel (1945) reported a follow-up of 195 cases in which only 7 per cent were unimproved Bull and Hiatt (1948), using the Mayo stripper in 562 cases at the Presbyterian Hospital in New York, reported one death due to embolism and a 40-month follow-up in 50 cases with only 3 unsatisfactory results.

I hope the reader will appreciate how misleading any statistics regarding this condition may be I have to restate this, owing to the number of factors which are so often present in the same limb prior to operation In other words, the statistics under review do not state the ages of the patients, the severity of the varices, presence or absence of incompetent communicators and perforators, the condition of the deep veins, whether deep vein thrombosis has ever been an antecedent, the general health of the patient, how much he stands or what his job is These are only a few of the factors which may influence the results of our operations, but a consideration of these alone should be sufficient to prove the old saying that there are " lies, damned lies, and statistics "

BIBLIOGRAPHY AND REFERENCES

(All references for this Chapter are to be found at the end of Chapter 11)

A DIAGRAMMATIC REPRESENTATION OF THE THREE COMMON SURGICAL OPERATIONS ON THE VARICOSE LIMB

(A) High resection of the internal saphenous vein

(B) High resection and stripping of the external saphenous vein

(C) The excision of blow-outs

(A) (i) *High resection of the internal saphenous vein*

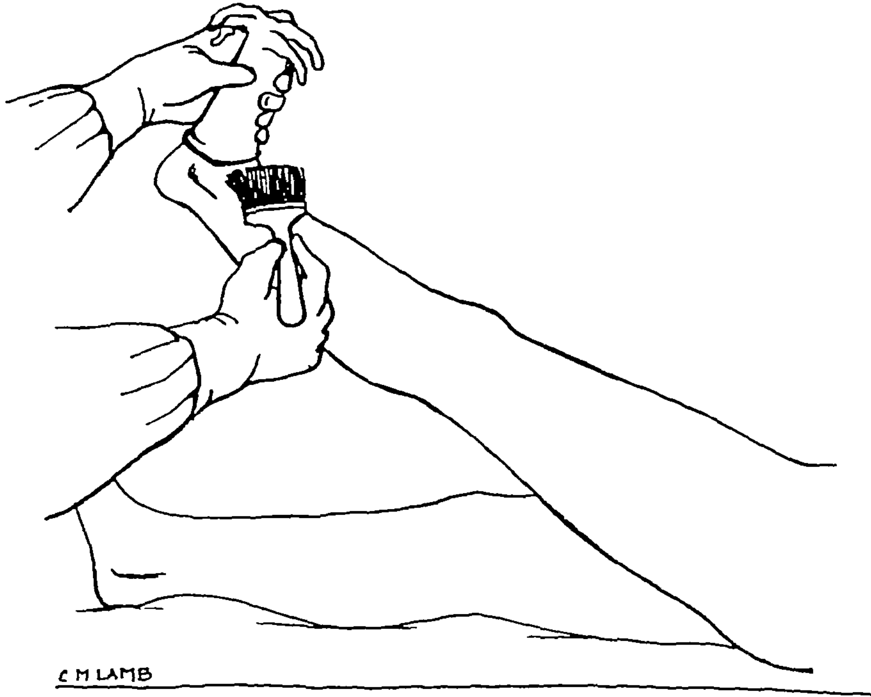


Fig 163—Preparation of the limb Overnight the patient has been shaved after a warm bath, and the leg has been painted with Cetavlon solution On the operating table the foot is painted with 1 1,000 Flavine in spirit solution, and a sterile glove is applied The limb is elevated and painted thoroughly with the Flavine solution This may be done with either swab or brush The latter, although quicker, tends to rub the markings from the limb unless they have been applied the night before

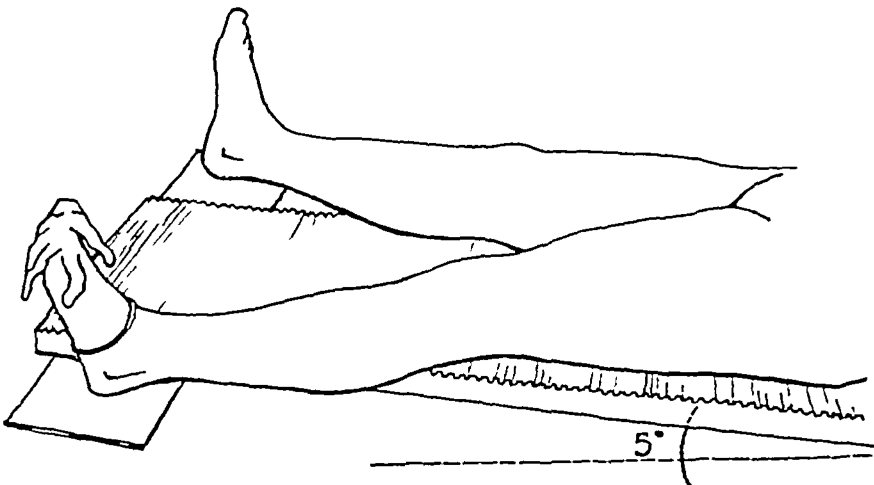


Fig 164—The limbs are spread widely on a board as illustrated The table is tilted about 5° and the limbs are then towelled as described on page 120

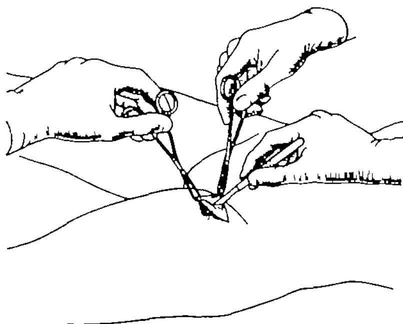


Fig 165

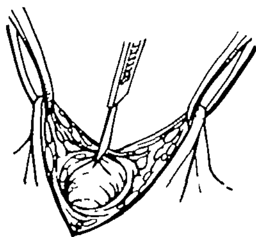


Fig 165 (*a*)

Fig 165 —This diagram emphasizes that lifting of the tissues once the superficial fascia has been incised is important. By this method the saphenous vein is made to fall away from the fat and subcutaneous tissue and the knife can be used until the vein is actually exposed to view The knife should not be dropped until the vein is seen, otherwise the fat and subcutaneous tissues may be pushed over the vein and the search prolonged This point is emphasized in Fig 165 (*a*) It should be noted that the incision in this diagram is being made too low In the majority of cases the crease of the groin will give the best exposure.

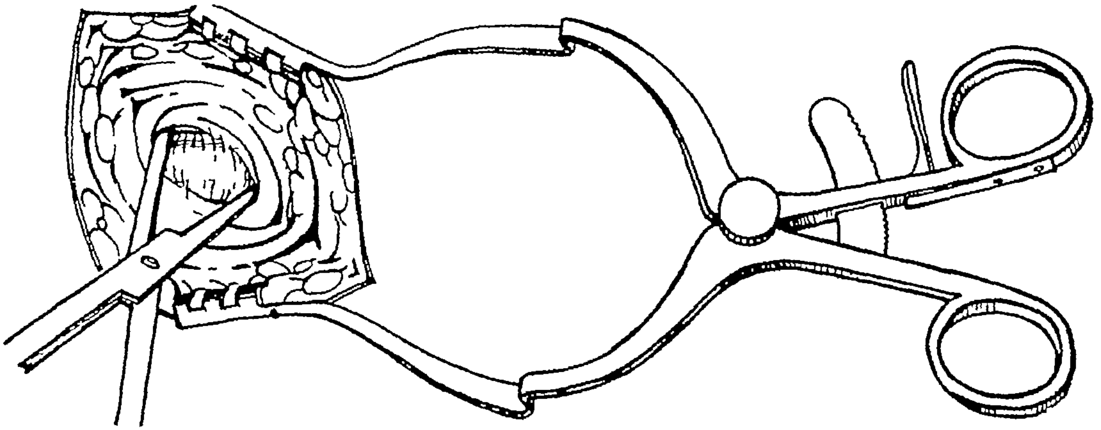


Fig 166 —The self-retaining retractor is placed in the wound and the saphenous vein is exposed by blunt dissection with a pair of straight artery forceps The skin edges can be lifted with the self-retaining retractor to help dissection

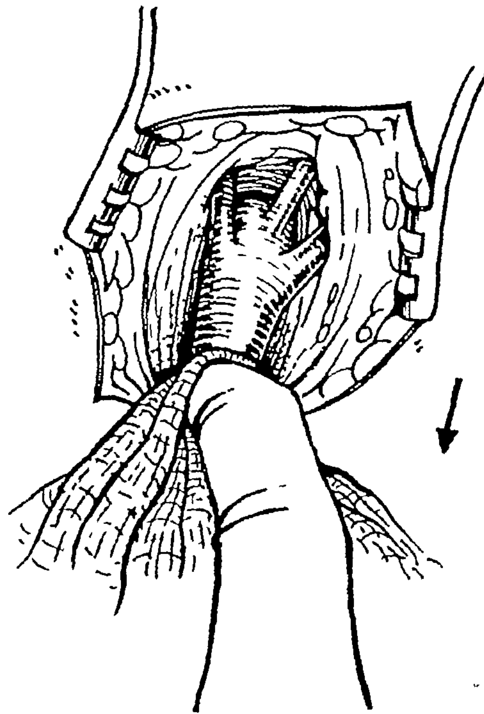


Fig 167 —The index finger covered with one layer of gauze i the tissues away from the vein with a single downward

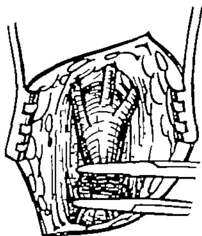


Fig 168—The main trunk is doubly clamped and divided about an inch below its termination

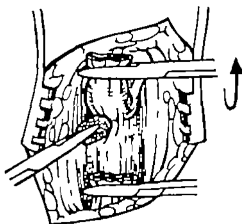


Fig 169—The proximal end of the internal saphenous vein is then reflected upwards in the direction of the arrow and cleaned with a Lahey swab until the sharp lower edge of the saphenous opening comes into view During this manoeuvre deep joining branches may come into view and should be noted and clamped

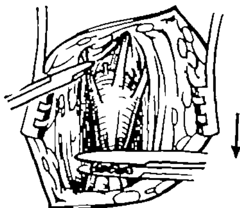


Fig 170—Gentle traction on the saphenous stump will help to bring the main joining branches into view These are then separately clamped and resected

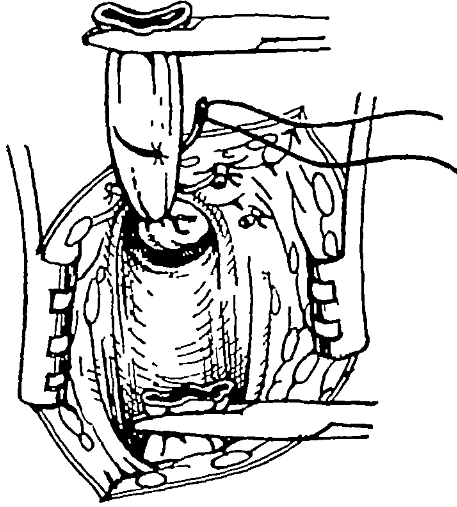


Fig 171 —The saphenous stump is then ligated about a quarter of an inch from its termination (not flush) This ligature is placed above most of the resected branches For added security a transfixing suture is then applied as shown In order to avoid pulling on the often delicate sapheno-femoral junction, a curved cutting needle is used

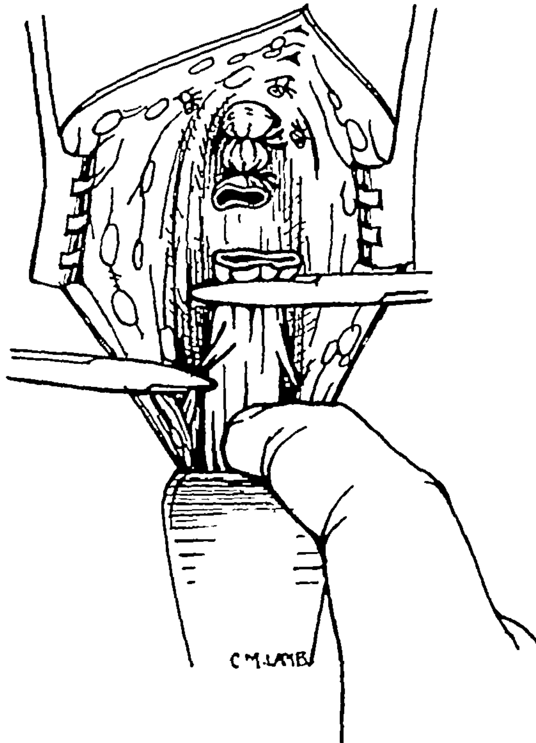


Fig 172 —Attention is now turned to the distal portion of the internal saphenous vein which is mobilized with the finger down to the limit of reach All joining branches are resected

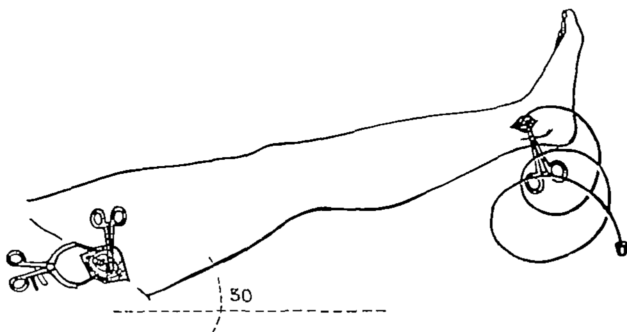


Fig 173

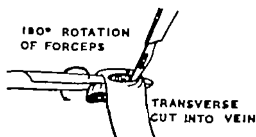


Fig 174

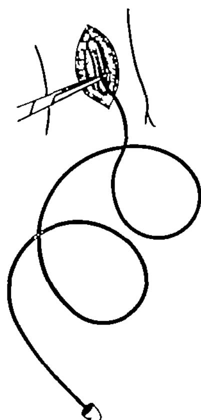


Fig 175

(A) (ii) *Stripping of the internal saphenous vein*

Fig 173 —The table is tilted to an angle of 30 The internal saphenous vein is exposed in front of the internal malleolus by a vertical incision and is then clamped The forceps are rotated as in Fig 174 The vein is then incised bloodlessly and the stripper inserted as in Fig 175 The stripper is then gently inserted up the leg as shown in Fig 173

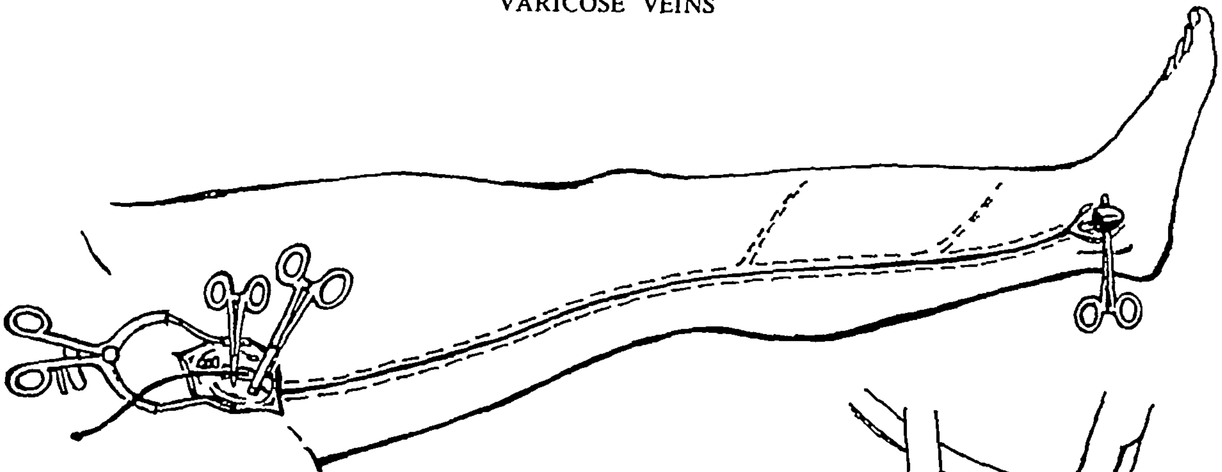


Fig 176

Fig 176 —The stripper wire has been passed to the top clamp, where it has been allowed to escape through a small incision A finger kept behind the vein during this procedure will prevent all bleeding A pair of forceps, whose blades have been covered with rubber tubing, is then applied to the vein containing the stripper wire This is demonstrated in more detail in Fig 176 (*a*) The surgeon's hands are now freed to tie the stripper head to the vein, which is then divided at the ankle, the distal portion being ligated The stripper head is eased through the lower incision by elevation of the top end of the wound with tissue forceps At this stage the surgeon reviews the position regarding any large joining branches, which are diagrammatically represented in Fig 176 Some of these he may feel it wise to resect close to the main channel Failure to do this in certain instances will cause the stripper head to "cock" (*see* Fig 177) If this happens he may well shred the main trunk of the vein, and have great difficulty in its final stripping

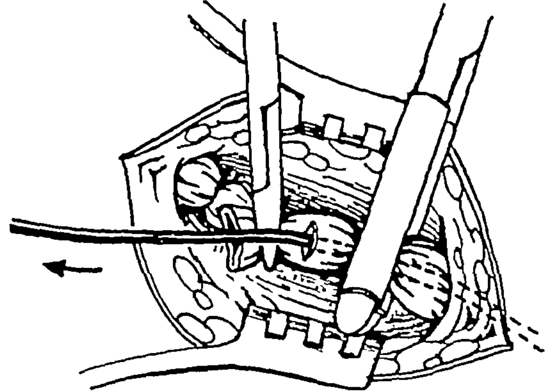


Fig 176 (*a*)

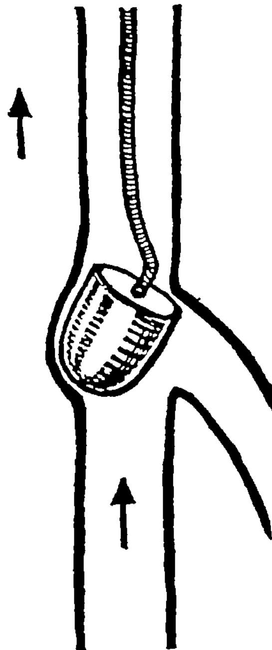


Fig 177—"Cocking" of the stripper head

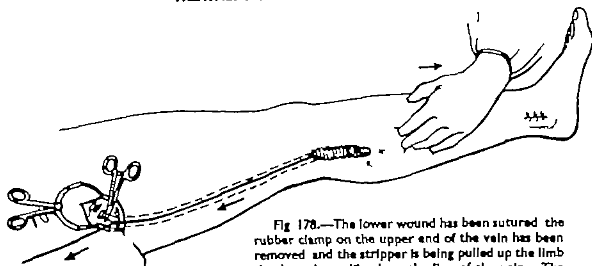


Fig 178.—The lower wound has been sutured the rubber clamp on the upper end of the vein has been removed and the stripper is being pulled up the limb slowly and steadily along the line of the vein. The pull must be in the direction of the vein, and the assistant s hand must tense the skin away from the ascending stripper head In this way he will help to attenuate joining branches.

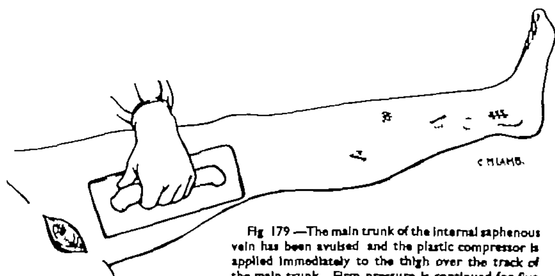


Fig 179 —The main trunk of the internal saphenous vein has been avulsed and the plastic compressor is applied immediately to the thigh over the track of the main trunk. Firm pressure is continued for five minutes. During this time blow-outs, if any are excised, remembering to make the incisions along Langer s lines. The top wound is then sutured using two or three stitches on a curved needle for the fascia, and finally using mattress sutures for the skin. (Linen thread size 90 is used throughout both for ligatures and sutures.)

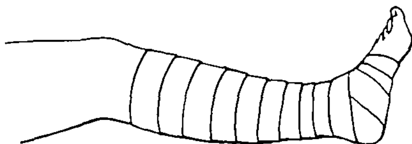


Fig 180 —Individual wounds are covered with pads of gauze kept in place by Elastoplast. The limb is then firmly compressed by means of a crêpe bandage from toe to knee. Any further padding and support is unnecessary The use of the compressor to the thigh will have prevented any excessive bruising in this area.

(B) *High resection and stripping of the external saphenous vein*

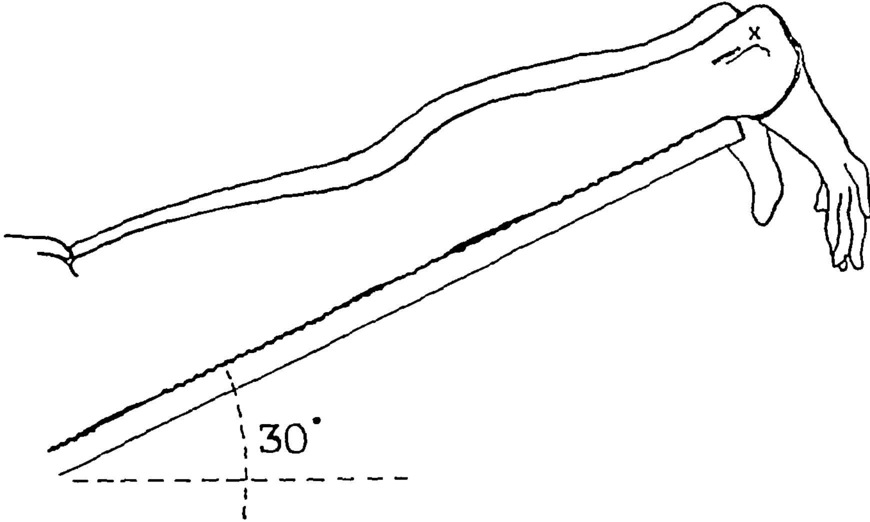


Fig 181 —The position of the patient is important The table is tilted to 30°, and the ankles are allowed to rest just over the end of the table A vertical incision is made over the lower end of the external saphenous vein, which was marked prior to operation This usually lies just external to the outer border of the tendo achillis

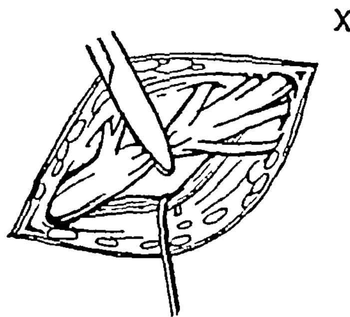


Fig 181 (a) —This figure demonstrates this lower wound The saphenous nerve, which usually lies externally, is retracted, while the main trunk of the vein is clamped Many joining branches may have to be resected at this point In the presence of blow-outs (ankle blow-out syndrome) the incision may be extended upwards or downwards so that they may be dealt with

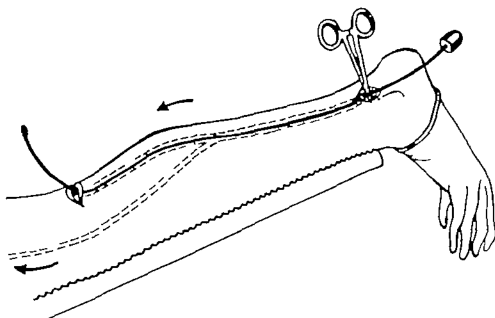


Fig 182.—The stripper wire is then inserted in precisely similar manner to that already shown when dealing with the internal saphenous vein. The external saphenous vein will have already been marked carefully before operation Its termination is very variable (see Fig 58) If on gently passing the stripper it will go no further once it reaches the commonest of the terminations behind the knee an Inverted thyroid" incision may be made at this point and the stripper wire released in a similar manner to that used when dealing with the internal saphenous vein The stripping from this point onwards is entirely similar but it will be noted that, unlike the internal saphenous vein the high resection operation is left until *after* the stripping

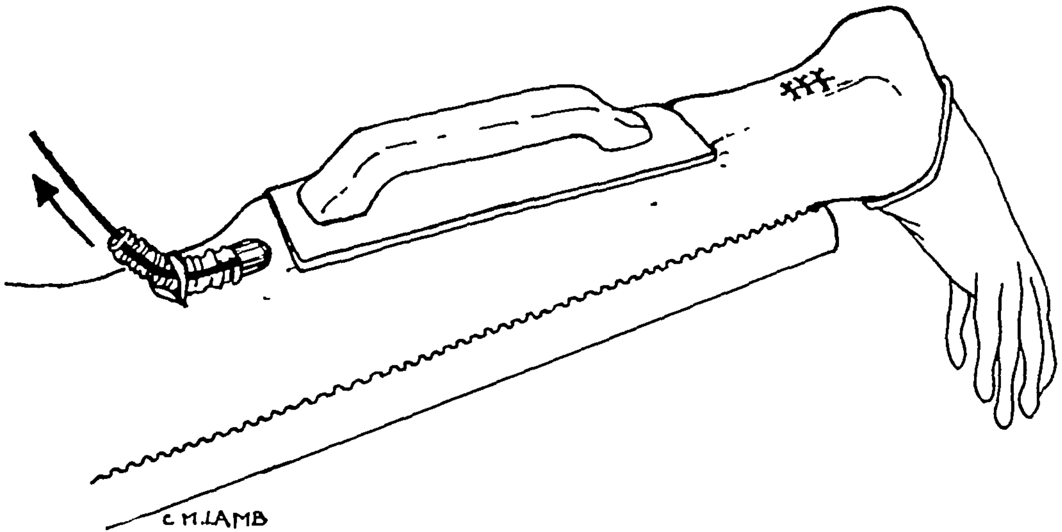
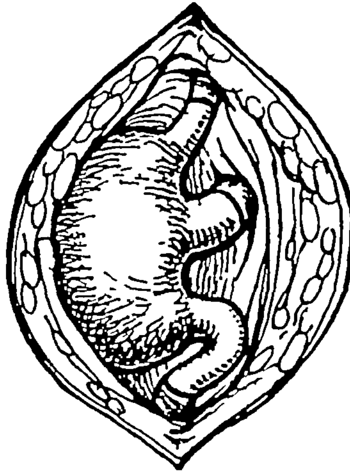


Fig 183—This figure shows extraction of the vein and the use of the compressor



(C) *The excision of blow-outs*

Fig 184—This picture demonstrates a fairly typical blow-out The incompetent communicating vein has caused the superficial vein to bulge and all that is necessary is to resect this T-piece Incisions are made along Langer's lines and should be adequate to give a full exposure The communicating vein is resected superficially to the deep fascia and very carefully ligated The hole in the fascia through which it travels may have to be sutured After sewing up, compression by means of a firm bandage over a roll of gauze will prevent haematomas and produce better healing The excision of blow-outs by the sub-fascial route (Linton's operation) is described on pages 161–163

CHAPTER 9

TREATMENT BY CONSERVATIVE MEASURES

THE CONSERVATIVE treatment of *uncomplicated* varicose veins is important Those patients who are not suitable for surgical treatment should not be dismissed but should receive careful advice as to how to control their varices The contra indications for active treatment are given elsewhere in this manual but in the main we reserve conservative therapy for the early cases of varicose veins in young people whose saphenous veins are still competent. Again, those who either by age or general health are unfit for surgical treatment can also be helped with a little common sense advice

Occupation

Obviously young people with a tendency to varicosis should avoid selecting work which entails prolonged standing Jobs which permit active exercise however are suitable

Pregnancy

The pregnant patient with a tendency to varices should receive firm support to her limbs in the early stages and this should not be discarded until her condition is satisfactory after parturition

Support

The most commonly used support for the mild varicose patient is the elastic stocking. So frequently these stockings are ordered without due thought to the condition of the veins or to the aesthetic angle as far as the patient is concerned. Supportive stockings may be divided into the full length type most acceptable to the female and the short stocking reaching to below the knee which we prescribe for our male patients The male calf if well developed, will prevent the short stocking from sagging We are sometimes confronted however with the male patient with poor muscular development who presents to us a considerable problem since short stockings refuse to stay in position In such cases we are bound to prescribe the full length stocking and the unfortunate sufferer perforce has to use a belt in order to support them The average man finds this uncomfortable and we have to try to avoid this whenever possible

One may find that the one way stretch type of short stocking will tend to stay up better than the two-way stretch type Again these stockings are made with and without covering to the heel Generally speaking, the male appears to be more comfortable in the type that has no heel. Amongst the stronger stockings which give firm compressive support I favour the Superlastik weave (Scholl) as demonstrated in Fig 185 This type is seamless and is acceptable from the aesthetic angle

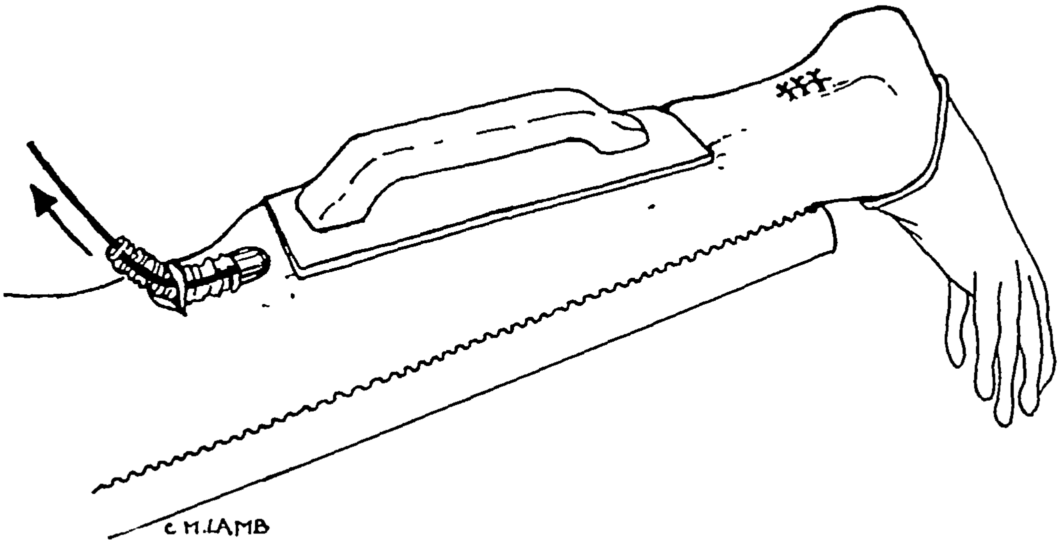
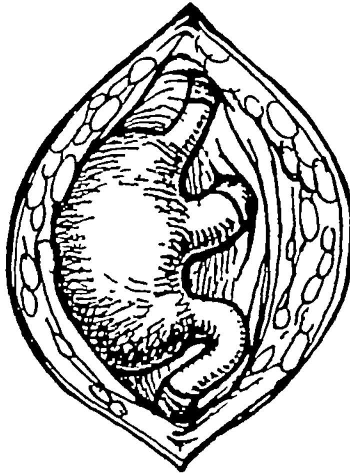


Fig 183—This figure shows extraction of the vein and the use of the compressor.



(C) *The excision of blow-outs*

Fig 184—This picture demonstrates a fairly typical blow-out The incompetent communicating vein has caused the superficial vein to bulge and all that is necessary is to resect this T-piece Incisions are made along Langer's lines and should be adequate to give a full exposure The communicating vein is resected superficially to the deep fascia and very carefully ligated The hole in the fascia through which it travels may have to be sutured After sewing up, compression by means of a firm bandage over a roll of gauze will prevent haematomas and produce better healing The excision of blow-outs by the sub-fascial route (Linton's operation) is described on pages 161–163

CHAPTER 9

TREATMENT BY CONSERVATIVE MEASURES

THE CONSERVATIVE treatment of *uncomplicated* varicose veins is important Those patients who are not suitable for surgical treatment should not be dismissed but should receive careful advice as to how to control their varices The contra indications for active treatment are given elsewhere in this manual but in the main we reserve conservative therapy for the early cases of varicose veins in young people whose saphenous veins are still competent. Again those who either by age or general health are unfit for surgical treatment can also be helped with a little common sense advice

Occupation

Obviously young people with a tendency to varicosis should avoid selecting work which entails prolonged standing Jobs which permit active exercise however are suitable

Pregnancy

The pregnant patient with a tendency to varices should receive firm support to her limbs in the early stages and this should not be discarded until her condition is satisfactory after parturition

Support

The most commonly used support for the mild varicose patient is the elastic stocking So frequently these stockings are ordered without due thought to the condition of the veins or to the aesthetic angle as far as the patient is concerned. Supportive stockings may be divided into the full length type most acceptable to the female and the short stocking reaching to below the knee which we prescribe for our male patients The male calf if well developed, will prevent the short stocking from sagging We are sometimes confronted however with the male patient with poor muscular development who presents to us a considerable problem since short stockings refuse to stay in position In such cases we are bound to prescribe the full-length stocking and the unfortunate sufferer perforce has to use a belt in order to support them The average man finds this uncomfortable and we have to try to avoid this whenever possible

One may find that the one way stretch type of short stocking will tend to stay up better than the two-way stretch type Again, these stockings are made with and without covering to the heel Generally speaking, the male appears to be more comfortable in the type that has no heel. Amongst the stronger stockings which give firm compressive support I favour the Superlastik weave (Scholl) as demonstrated in Fig 185 This type is seamless and is acceptable from the aesthetic angle

Fig 186 demonstrates the short stocking, in this instance the two-way stretch type, but, as already pointed out, if this is difficult to keep up correctly the one-way stretch type should be tried

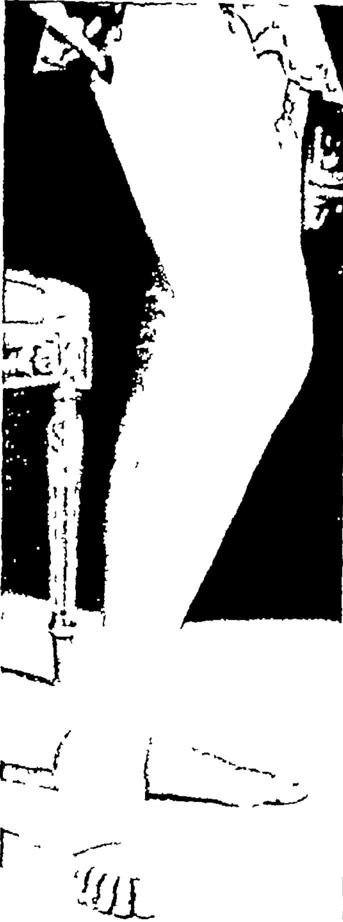




Fig 185 *Fig* 186

FIG 185 —The full-length seamless two-way stretch elastic stocking This type of stocking is more suitable for women, and modern manufacture of certain types has made them sufficiently strong not only to give support but also a degree of compression

FIG 186 —The heavy two-way stretch short stocking This is a type usually recommended to men, and can be obtained in the form of coloured socks, so that no oversock is required This is an improvement not only from the aesthetic point of view, but also from that of comfort

If only a mild degree of support is necessary one of the net stockings of the type illustrated in Fig 187 is useful This type may give less support but is useful, as we have said, in mild cases and in the tropics

The Lastonet type of stocking may be worn without an overstocking This gives a splendidly cool support and is in no way unsightly

For those who need a mild degree of support or who wish to hide the blemishes on their legs the reinforced nylon stocking, which is worn alone without an overstocking, is useful (*see* Fig. 188)

From these few remarks about stockings it will be seen that it is no use just ordering elastic stockings The shape of the limb the degree of varicosity the mentality of the patient, etc must all be considered before selecting the right form of support

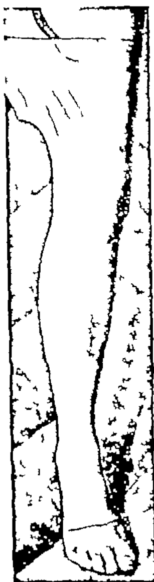


FIG 187 —The Lastonet stocking This form of support is suitable for the limb which does not require firm compression treatment. It will be noted in Chapter 16 that it may also be used in conjunction with an elastic bandage



FIG 188 —Scholl Nylastik stocking. A reinforced nylon stocking which can replace an ordinary nylon stocking whenever moderate support is required.

Exercises

All exercises directed towards emptying the veins are of value In particular "riding a bicycle in the air (*see* Fig 189) for a few minutes morning and evening is the best form of movement to prescribe.

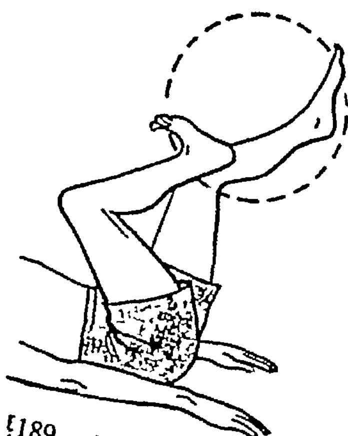


FIG 189—"Bicycling in the air" exercise This is a most valuable exercise because it combines elevation of the legs with active use of the calf muscle pump It is important to "use the pedals" by moving the ankles fully with each circle

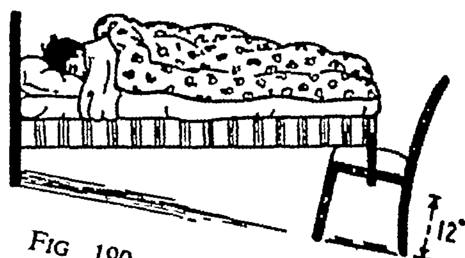


FIG 190—Method of elevating the foot of the patient's own bed at home It is advisable to use two chairs rather than one, as shown in the diagram, to prevent the risk of the bed tilting sideways



FIG 191—This chair is of the very greatest value in all cases which show oeder The patient will find that she can perform many of her household tasks while sitting the chair with her feet elevated. Frequent short rests during the day are of far mo value than single prolonged periods



Many household tasks can easily be performed while sitting with the legs comfortably elevated

Postural drainage

The foot of the bed may with advantage be raised at night (*see* Fig 190) The special chair or a modification (*see* Fig 191) should be used whenever possible

The new way of life

Under this heading the patient should be instructed to take the weight off her legs as frequently as possible in everything that she may be doing In other words elevation of the limbs when sitting down (*see* Fig 192) never standing for any length of time when sitting is possible using a shooting stick whenever possible such as when playing golf or instead of standing at a football match Impress upon the patient that she halves the column of blood in her limb when the knees are flexed. Again if she has to stand for prolonged periods behind a bar or shop counter even short rests with the legs elevated on the rung of a stool of the type depicted in Fig 193 would be advantageous

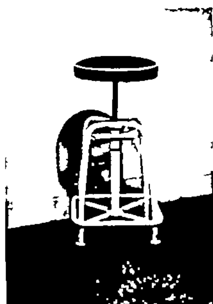


Fig 193 —Special stool The use of a stool at work whenever possible is obviously to the patient's advantage.

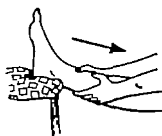


Fig 194 —Self-massage with firm sweeping strokes from ankle to knee is of great value in removing oedema fluid from the leg. The limb should be kept elevated during this massage

Self massage

Sweeping the blood up the legs in the manner shown in Fig. 194 is a good habit to develop after a bath and those who can afford it are well advised to combine this with a maintenance dose of skilled massage from a physiotherapist

These various points in the conservative treatment of varicose veins are readily learned by the intelligent patient and it is not a bad plan to write down the main points for her in the form of a prescription Explain to her that by keeping the weight out of the varices not only will they benefit but she will also delay complications and possibly operation

CHAPTER 10

TREATMENT BY SCLEROSANT INJECTIONS

IN THE last edition of this manual I discussed the controversy which had arisen over the use of sclerosants in the treatment of varices I am deleting those pages since even the most ardent " injector " seems to have now been converted as far as their use generally is concerned In the days of incomplete surgery sclerosants were indeed good friends—in fact, we had very little else to offer to our patients Now that the surgical approach has been revolutionized by efficient stripping in conjunction with a careful high resection of the diseased vein sclerosants play but a very minor part in treatment

I have used sclerosants for 36 years and have had plenty of opportunity to study not only their effects but also the complications associated with them I have been able to follow the results of their use over the decades and am most regretful to have to abuse old friends However, we still can recommend their use in a very limited field, and for this reason I propose to discuss the technique of injection in detail, and furthermore, to give an extensive bibliography for those who wish to read further

Contra-indications to the use of sclerosants

Before discussing the indications for the use of sclerosants I would like to enumerate, first and foremost, the conditions under which, in my opinion, they should be banned These are injections

(1) Into the incompetent trunks of either the internal or external saphenous vein

(2) Into any *large* branch of the saphenous system where a previous high resection or stripping has not been performed

(3) Into large " blow-outs " (faulty communicating veins)

(4) Into the limb which is the seat of deep vein thrombosis (unless it be to dry up temporarily the superficial " feeding vein " of an ulcer)

Injections under the above conditions can do no good and may well do harm How often do we find the stripping of a limb made difficult for us by the effects of past injections which have caused a peri-phlebitis and " stuck " the vein to the tissues in its course Again, sclerosants used at the time of operation in the form of retrograde injection can convert a comparatively healthy limb into one suffering from deep vein thrombosis with all its distressing sequelae I agree that their use under these conditions if given with great care by someone who is dealing with many limbs every week, is not great, but the occasional operator is likely to find many cases of post-operative deep vein thrombosis occurring, a fact which can be confirmed by the many writings on the subject

In the past seven years I have used teaspoonfuls of sclerosant instead of gallons as in the previous years The results of therapy, nevertheless, improved out of all knowledge The proof of the pudding is indeed in the eating

Indications for the use of sclerosants

I reserve injection treatment for the following groups

(1) During the "follow up after stripping This is the most frequent indication

(2) Small radicles treated for cosmetic reasons only

(3) The superficial feeder vein leading to an ulcer

(4) Fine subcuticular branches which have ruptured or are about to rupture

(5) The cavernous haemagioma can be made smaller by means of sclerosants Large dosage is usually required The condition may be controlled in this way and may make later surgery less difficult

Except for the above indications I prefer surgical or conservative treatment



FIG 195 —Photograph showing the more common sites at which residual tributaries might be found after the internal saphenous vein has been removed by stripping. These are the veins which can be obliterated by sclerosant injections.

Injection of those branches which have missed avulsion in the stripping operation

It will be found in the surgical chapter that we are not always sufficiently fortunate to remove all the smaller branches at the time of stripping These may shrivel up a few months after the operation but if they do not do so a *small*

CHAPTER 10

TREATMENT BY SCLEROSANT INJECTIONS

E last edition of this manual I discussed the controversy which had arisen over ;e of sclerosants in the treatment of varices I am deleting those pages since the most ardent " injector " seems to have now been converted as far as their enerally is concerned In the days of incomplete surgery sclerosants were d good friends—in fact, we had very little else to offer to our patients Now he surgical approach has been revolutionized by efficient stripping in con- on with a careful high resection of the diseased vein, sclerosants play but a ninor part in treatment

ave used sclerosants for 36 years and have had plenty of opportunity to study ıly their effects but also the complications associated with them I have been o follow the results of their use over the decades and am most regretful to to abuse old friends However, we still can recommend their use in a very d field, and for this reason I propose to discuss the technique of injection in , and furthermore, to give an extensive bibliography for those who wish to 'urther

ra-indications to the use of sclerosants

:fore discussing the indications for the use of sclerosants I would like to erate, first and foremost, the conditions under which, in my opinion, they d be banned These are injections

) Into the incompetent trunks of either the internal or external saphenous

) Into any *large* branch of the saphenous system where a previous high ion or stripping has not been performed

) Into large " blow-outs " (faulty communicating veins)

) Into the limb which is the seat of deep vein thrombosis (unless it be to dry nporarily the superficial " feeding vein " of an ulcer)

jections under the above conditions can do no good and may well do harm often do we find the stripping of a limb made difficult for us by the effects st injections which have caused a peri-phlebitis and " stuck " the vein to the s in its course Again, sclerosants used at the time of operation in the form rograde injection can convert a comparatively healthy limb into one suffering deep vein thrombosis with all its distressing sequelae I agree that their use these conditions, if given with great care by someone who is dealing with limbs every week, is not great, but the occasional operator is likely to find cases of post-operative deep vein thrombosis occurring, a fact which can be med by the many writings on the subject

the past seven years I have used teaspoonfuls of sclerosant instead of gallons the previous years The results of therapy, nevertheless, improved out of all ledge The proof of the pudding is indeed in the eating

(2) Two stools if the patient is receiving an injection in the sitting position he may sit on the end of the couch and support his feet on one stool. The other stool is for the operator and is of such a height that when giving the injection his hands are at a convenient level

(3) Good illumination, such as that given by the Anglepoise light fitted with an artificial-daylight bulb

(4) A supply of 2 millilitre 5-millilitre and 10-millilitre syringes The all-glass type is very satisfactory

(5) Needles of varying sizes. There are many needles on the market reputed to have special advantages for injecting varicose veins, but there is no particular advantage in their use. The author has a particular preference for a wide bore needle since this allows a quick delivery of the solution, and also because once it is introduced into the vein blood flows rapidly into it giving a definite indication that the needle is in the right place Needles of finer bore may leave the operator in doubt as to whether his injection will be truly intravenous

(6) Surgical spirit and cotton wool swabs

(7) Cellophane tape which is used for compressing the wool swab on to the skin puncture following the injection This tape is cheap oozing of blood can be seen through it and allergic reactions which sometimes make themselves evident with Elastoplast do not occur

(8) A supply of sclerosant solutions. These are described in detail later

(9) Two pairs of Spencer Wells forceps and two rubber catheters If a tourniquet is required the forceps are used to clip the catheter into any position for this purpose

(10) Ampoules of 1 1 000 adrenalin for use in possible cases of collapse

(11) A vertical bar attached to the wall is a useful support for a patient who is receiving an injection in the standing position This may be fitted over the stool at the end of the couch.

Sclerosant solutions

The following are sclerosant solutions in use.

(1) Phenol, 2 per cent, in 30 per cent glycerin.

(2) Monoethanolamine oleate

(3) Quinine urethane (Génévrier s solution)

(4) Sotradecol (sodium salt of tetradecyl sulphate)

The ideal solution should produce a chemical injury of the intima which is followed by thrombosis and obliteration of the vein. It should not cause untoward local effects such as sloughs or cramping, or untoward general effects such as collapse of the patient, urticaria and cinchonism. A solution fulfilling all these requirements has yet to be found, but the four solutions mentioned above are in the author s opinion nearest to the ideal at the present time We must repeat that sclerosants are valueless when injected into veins containing blood circulating under pressure This is found in the presence of faulty communicating veins or in the saphenous system when the valves are grossly incompetent. This fact cannot be repeated too often

Since most operators have their own personal likes and dislikes so far as sclerosant solutions are concerned it is proposed to discuss each of these solutions giving the main indications for their particular usage and the good and bad points of each

amount of sclerosant will cause them to disappear This is a very definite indication for the use of sclerosants which are invaluable in the follow-up routine after surgical interference After a complete stripping it is as well to wait *at least two months* before using a sclerosant So often the few branches left will have sclerosed and disappeared during this time

Cosmetic reasons

Sir Heneage Ogilvie (1945) stated " I am afraid the time has come to consider seriously whether the injection treatment of veins has any place in legitimate therapy For those who would dally on the slippery slopes of cosmetic surgery it has its attractions, for it is a cosmetic procedure and no more The injection of a prominent vein will cause that vein to disappear " Even though this statement is made by a surgeon of international renown, we have to ask ourselves whether it is entirely fair comment as far as the much maligned sclerosant is concerned The presence of an ugly and disfiguring varix under a fine nylon stocking can be a source of great worry to the patient Surely we are fully justified in treating such cases by means of sclerosants? Intracutaneous varicose veins of the rocket-burst, spider-burst or hair-vein types may also derive benefit from sclerosant treatment These hair veins usually have a "feeder vein" and sometimes may be found to be difficult to inject, and this technique is described elsewhere

It is also justifiable to inject small branches which occur unassociated with incompetence of the main trunks of the saphenous veins These veins may be made to disappear permanently in some cases and for many years in others The relief given to the sensitive female mind is considerable, and in the author's opinion is entirely justified As previously stated, when dealing with large radicles it is better to remove them through small incisions By so doing, our treatment is more permanent and is certainly less painful

The "feeder vein " of a varicose ulcer

Sclerosants are of use in the injection of the " feeder vein " of a varicose ulcer, even in the presence of a deep vein thrombosis Care must be taken not to give an excessive dosage This type of treatment is sometimes of value as an aid to the healing of an ulcer prior to operative treatment The feeder vein to which we refer is in the *superficial system, and not an underlying communicating vein* Injection of a blow-out may cause considerable trouble, since the sclerosant is delivered directly into the deep circulation

The injection of a small varix on the point of rupture

The black subcutaneous small varix which has either bled in the past or is just about to rupture can be sclerosed and made to disappear with a small injection As a rule a few drops of monoethanolamine oleate delivered by a fine needle at a distance from the varix is all that is necessary The needle should not be passed directly through the skin into the varix

Equipment for injection treatment

Special equipment is not needed for the treatment of varicose veins by injection, but the following is a list of the usual requirements for the consulting room

(1) An ordinary examination couch

(2) Two stools If the patient is receiving an injection in the sitting position he may sit on the end of the couch and support his feet on one stool. The other stool is for the operator and is of such a height that when giving the injection his hands are at a convenient level

(3) Good illumination such as that given by the Anglepoise light fitted with an artificial-daylight bulb

(4) A supply of 2-millilitre, 5-millilitre and 10-millilitre syringes. The all glass type is very satisfactory

(5) Needles of varying sizes There are many needles on the market reputed to have special advantages for injecting varicose veins, but there is no particular advantage in their use. The author has a particular preference for a wide bore needle since this allows a quick delivery of the solution, and also because once it is introduced into the vein blood flows rapidly into it giving a definite indication that the needle is in the right place. Needles of finer bore may leave the operator in doubt as to whether his injection will be truly intravenous.

(6) Surgical spirit and cotton-wool swabs

(7) Cellophane tape which is used for compressing the wool swab on to the skin puncture following the injection This tape is cheap, oozing of blood can be seen through it and allergic reactions which sometimes make themselves evident with Elastoplast do not occur

(8) A supply of sclerosant solutions. These are described in detail later

(9) Two pairs of Spencer Wells forceps and two rubber catheters. If a tourniquet is required the forceps are used to clip the catheter into any position for this purpose

(10) Ampoules of 1 1,000 adrenalin for use in possible cases of collapse

(11) A vertical bar attached to the wall is a useful support for a patient who is receiving an injection in the standing position This may be fitted over the stool at the end of the couch

Sclerosant solutions

The following are sclerosant solutions in use.

(1) Phenol, 2 per cent in 30 per cent glycerin.

(2) Monoethanolamine oleate

(3) Quinine urethane (Génévrier s solution)

(4) Sotradecol (sodium salt of tetradecyl sulphate)

The ideal solution should produce a chemical injury of the intima which is followed by thrombosis and obliteration of the vein. It should not cause untoward local effects such as sloughs or cramping, or untoward general effects such as collapse of the patient, urticaria and cinchonism. A solution fulfilling all these requirements has yet to be found, but the four solutions mentioned above are, in the author s opinion nearest to the ideal at the present time We must repeat that sclerosants are valueless when injected into veins containing blood circulating under pressure This is found in the presence of faulty communicating veins or in the saphenous system when the valves are grossly incompetent. This fact cannot be repeated too often

Since most operators have their own personal likes and dislikes so far as sclerosant solutions are concerned it is proposed to discuss each of these solutions giving the main indications for their particular usage and the good and bad points of each

with a low degree of toxicity Having tested this substance the author feels that the results obtained from it differ little from those that can be expected from monoethanolamine It has the advantage, however, of being available in 1, 3 and 5 per cent strengths

Effects of the injection

Immediate local effects

Few immediate local effects will be experienced when using the solutions already described It is absolutely essential that the needle be sharp and kept sharp in the



FIG 197—*Position of patient for injection Standing It is important that the* patient should have some strong support to hold as it is not uncommon for her to feel faint during the injection Note that a good light from an oblique angle is of great assistance With the patient standing, a tourniquet is rarely necessary

manner described later, since this is the secret of efficient injection therapy Ethamolin, quinine and phenol solutions hardly produce any sensation on injection Hypertonic saline solution, as previously stated, is too painful for use without a general anaesthetic, even when it is given correctly into the vein.

Some veins thrombose within a few minutes after injection but with others the reaction may be held up for 3 or 4 days The dosage should always be such

that it will produce an adequate thrombosis which must not be too extensive or too intense.

Mild oedema of the foot and ankle sometimes occurs after injection but subsides within a few days and may be disregarded. Bruising of the skin may be avoided if the "valve technique" described elsewhere is utilized. The discoloration of the skin which sometimes occurs after injection is most troublesome and may be permanent. This pigmentation can often be traced to an excessive dosage or to a mild leakage of the solution perivenously.



FIG 198.—Position of patient for injection: Sitting. This is the most comfortable and satisfactory position for both surgeon and patient. A tourniquet may or may not be necessary. It is best to have the patient sitting on the couch, resting the feet on a stool or chair.

Immediate general effects

Precautions must be taken against fainting. This is far more likely to happen if the patient is injected in the standing position, and it is as well to have someone present to watch the effects of the injection. Allergic responses to the injection of a sclerosant may be very severe and are commoner with the fatty acid agents

The immediate injection of adrenalin is called for in severe cases, whereas an oral dose of Benzedrine is useful for those cases of a lesser severity which may be affected by headaches or a feeling of malaise

Late local effects

The veins which have " taken " and have become thrombosed may be felt as hard cords beneath the skin In the course of time these veins either shrivel up and become small nodules under the skin or else recanalization occurs The statistics regarding the recurrence rate following injection are variable, as are all statistics They are of very little importance to us since the recurrence rate is dependent upon the type of vein injected Recurrences are early and are usually

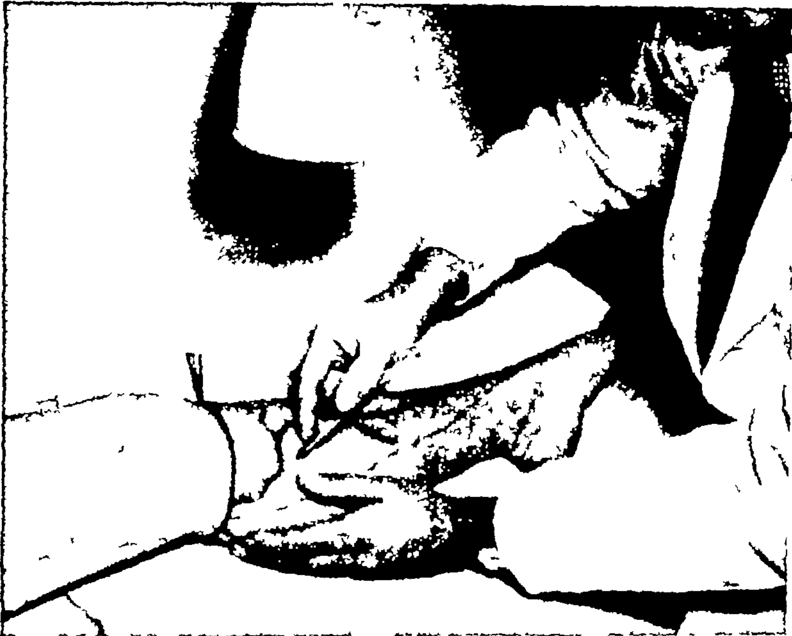


FIG 199—*Position of patient for injection* Lying *In this position* the use of a tourniquet is usually necessary Note the value of an adjustable lamp to provide oblique illumination

complete when veins with incompetent valves are subjected to sclerosant treatment alone Conversely, the injection of small intracutaneous veins may give permanently good results

The position of the patient

This depends upon whether the " empty " or the " full " vein technique is to be employed The advantage of giving the injection with the patient standing is that the vein is distended and easier to enter with the needle and therefore there is less risk of accidentally injecting the solution subcutaneously instead of into the vein Many clinics favour this procedure but whenever practicable the empty vein technique is to be preferred for the following reasons

(1) While lying down the patient is less likely to suffer from acrophobia, is more relaxed and therefore less apprehensive

(2) Less solution is required for an empty vein because the vein walls are more closely in contact with the chemical irritant injected, and therefore less periphlebitis is produced by the injection

(3) The fluid is not diluted or rendered inert by injection into a pool of blood

(4) A smaller thrombus is formed The rate of absorption of a large thrombus is slow and efficient damage to the intima is prevented, making recanalization more likely to occur

(5) The production of a leak ulcer is less likely than when the vein is distended with blood during an injection

A superior cosmetic effect is obtained by injection into collapsed veins as the discoloration and ugly indurations produced by the gross thrombus formation resulting from the use of a strong dose into full veins are avoided When injections are given into distended veins the common sequelae are painful, hard, nodular masses with considerable oedema in the perivenous tissues

In some cases the empty vein technique is difficult. In such instances a tourniquet is applied with the patient in the standing position he then lies down, the needle is inserted the tourniquet is removed, the blood is massaged away from the needle until the vein is empty and the injection can then be given

The cases which, even with the help of a tourniquet prove impossible for this technique should be injected in the sitting position with the legs hanging over the edge of the couch and the feet resting upon a stool If this is not possible, the injections will have to be given in the standing position Whichever position is adopted the main point is that the patient should be steady and comfortable The operator should work from a convenient angle with a good view

The injection aims at putting the solution into the lumen of the vein and causing it to remain there sufficiently long to destroy the intima. If the vein is not obstructed with blood this destruction normally occurs within 60 seconds

The Injection

The following routine is advocated

(1) The skin should be cleansed with surgical spirit.

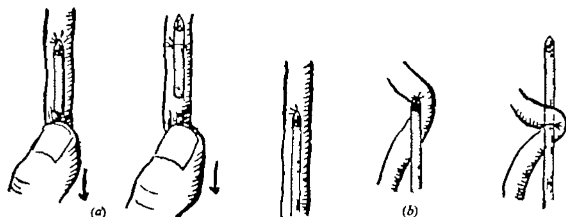


FIG 200—(a) The manner in which the vein should be "fixed" before the injection is given. The operator should exert a downward traction with his thumb Failure to take this precaution will result in the transfixion of the vein as demonstrated in (b)

(2) The thumb is placed on the skin below the vein to be injected and slight downward pressure is exerted, thus fixing the position of the vein by making the skin tense (Fig. 200)

(3) The needle is inserted through the skin and made to travel along the surface of the vein for a short distance before entering the vein In this way the skin puncture is not opposite to the vein puncture and a valve is formed, preventing the reflux of solution which might cause a leak ulcer.

(4) The needle should not be made to enter at an acute angle and the bevel of the needle should face away from, but be almost parallel with, the vein. The



FIG 201 —The position of the operator's hands during the injection is a matter of importance It is necessary for him to obtain a clear view of the syringe contents, and also to be assured that the needle point does not move after it has entered the vein These results may be obtained if the operator's ring finger and little finger are allowed to rest on the patient's leg

needle should not be inserted through unhealthy skin, and puncture of eczematous, indurated or pigmented areas should be avoided The introduction of the needle into a bulge in a vein where there is poor skin covering should also be avoided This bulge may be the " blow-out " caused by an incompetent communicating vein

(5) During the injection the syringe is steadied with the ulnar surface of the ring and little fingers and, if comfortable, the hypothenar surface of the hand may be rested against the patient's leg (Fig 201)

(6) The plunger of the syringe is withdrawn slightly and enough blood aspirated to ensure that the needle has actually entered the vein A wide bore needle renders this procedure simple

(7) The injection should be stopped if (a) a swelling occurs at the site of injection (b) pain occurs, (c) excessive pressure is required to produce an advance of the plunger should the plunger stick during the injection gentle *rotation* will cause it to become free, or if (d) blood does not suck back at times of testing or if the operator is at all in doubt. Failure to observe these precautions may mean an injection ulcer if certain of the sclerosants already discussed are being employed.

(8) When the injection is completed the needle should not be withdrawn for about 10 seconds and then only if the pressure over the needle is maintained with a spirit-soaked swab If this precaution is followed a few leak ulcers are avoided, particularly if the leg is raised slightly for a few minutes after treatment.

(9) A cotton wool swab is strapped over the puncture with a piece of Cellophane tape which should be left in position for a few hours A *crêpe* bandage applied to the leg after injection is a great help when injecting larger veins in the lower leg, as it keeps the veins empty and makes the patient comfortable

(10) On discharge the patient must be told to carry on with his normal duties and not on any account to retire to bed.

It is usual to leave an interval of one week between injections, but discretion should be used in spacing the injections having regard to the reaction of the patient, the nature of his work and other relative factors

The injection of veins which require a special technique

Hair veins —Hair veins are best treated by shaking up ½ millilitre of monoethanolamine oleate in the barrel of the syringe and injecting the froth into the "feeder vein which if it cannot be seen can usually be felt through the skin underneath this bunch of fine varices The bubbles will be seen to traverse the venules and form an indication as to the amount which needs to be injected

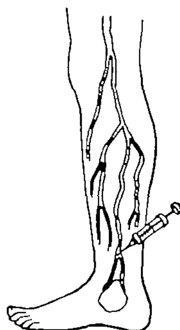


FIG 202 —A diagrammatic picture to demonstrate the injection of veins at a distance from the ulcer of which they are the cause The veins in the immediate vicinity of the ulcer may be referred to as "feeder veins"

Roller veins (*see* Fig. 90) —These veins around the dorsum of the foot and around the ankle are difficult to inject, since they tend to roll about under the skin like whipcord. Injection in this area is also painful and ineffective If it is necessary to remove these veins for cosmetic reasons, excision and stripping are the methods of choice

Varicose veins of the vulva —As previously mentioned these veins are unsuitable for injection Injection is very difficult and does not produce good results

The smallest error may produce cellulitis or slough Many authorities, such a McPheeters and Anderson (1938) and Solomons (1950), do not agree with thi view

Complications

Serious complications are few The statistics of McPheeters and Rice (1928) show that out of 53,000 cases which were treated by injection therapy only 7 death were attributed to the treatment Over a period of 5 years Edwards (1934) hac



FIG 203 —Localized pressure by means of adhesive felt strips This procedure may be useful after the injection of a large varix which has proved resistant to previous injections The application should be made immediately after treatment with the patient in the recumbent position This method is also of use after local excision of varices Pressure helps the wounds to heal by filling up the " dead space " under the excision

no recognized case of embolism after 20,000 injections The author has had no serious complications of this type over the past 36 years Such complications as do occur, with the exception of pulmonary embolism, are due to errors in technique The following points must be stressed in order to avoid complications

(1) No patient should be kept in bed after treatment In the large series of McPheeters and Rice, mentioned above, 3 out of 7 cases of death were due to embolism, and of these 3 fatalities 2 had been kept in bed after injection The

findings of most surgeons cause them to make a strong plea for ambulatory treatment for such cases If for some reason the patient must be kept in bed it is essential that active movements of the limbs are maintained throughout that time

(2) Scrupulous asepsis must be observed throughout the process of the injection

(3) No massage should be given to the leg after injection.

(4) The most careful technique may be followed by an injection ulcer This complication however may be minimized if the precautions given under the heading The injection are observed

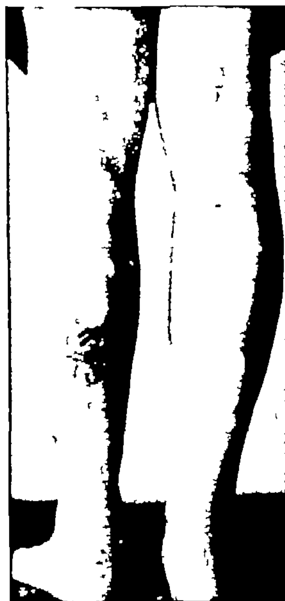


FIG 204—An injection ulcer which was occasioned 18 months before the taking of this photograph. Since that time glycerin dressings had been employed. Healing occurred rapidly once the condition was treated by means of Elastoplast strapping of the lower leg. This treatment produces rapid healing and also serves the purpose of causing the patient less worry since the ulcer is out of sight of both patient and physician. Excision of these ulcers is recommended by Barrow (1948) but in the author's opinion this is seldom necessary

(5) Leak ulcer and the necessary prophylactic measures have already been discussed

(6) Cellulitis is the result of a grave error in technique It is caused by the injection of a large quantity of solution outside the vein

(7) Persistent oedema may result if the injections are given in the presence of an unsuspected deep vein thrombosis The application of supportive bandages for the limb is all that can be done for these cases

(8) A latent superficial thrombophlebitis may be stirred up by injection and may be due to the presence of such a condition as sinusitis In these cases the patient should be kept ambulatory and a firm support should be given to the limb A pad may be required over the saphenous opening and is described in Chapter 13

Treatment of injection ulcers

Those who are unfortunate enough to cause an injection ulcer are recommended to apply a firm Elastoplast bandage from the toe to the knee. According to the size of the ulcer this should be left in place for 1–2 months On removal of the bandage the ulcer will probably be healed, the Elastoplast has served the useful purpose not only of healing but of keeping it away from the sight of the patient and, what is equally important, out of the sight of the operator

BIBLIOGRAPHY AND REFERENCES

(All references for this Chapter are to be found at the end of Chapter 11)

CHAPTER 11

THE TREATMENT OF SURGICAL FAILURES

SECOND-HAND surgery is frequently required in the treatment of the varix This is not necessarily a reflection on the original operative procedure since even after the most careful stripping recurrence is always possible It should, however, be taken as a maxim that *the more completely the superficial venous system is removed in conjunction with a perfect top tie the longer it will be before any further development of a new superficial system occurs*

I am satisfied that my technique up to nine years ago was unsatisfactory I now see many of the recurrences in my patients operated upon before that date The first description of stripping by a modified Myers method to be written in this country was produced by me and followed by a film of the procedure in 1952 I merely mention this fact since it allows me to make the point that during the 9-year period I have stripped " an awful lot of legs " having regard to the fact that this is my sole operative speciality My list in this country cannot compare with many in the U S A where in clinics such as Myers s the results of stripping go back for many years before we started over here For this reason I shall make frequent reference to his writings

Figures from clinics in this country might be misleading since the modern methods of Myers have been practised here by most surgeons for too short a period In Chapter 8 I have already discussed some details of recurrence after stripping operations but feel that these points are important enough to be restated

It is difficult to *define* recurrence after operation All patients however carefully stripped at the time of the original operation are candidates for a certain degree of recurrence however minor at some later date It is for that very reason that we examine them all annually after operation

I think it is best to divide our recurrence rate into

(1) *Gross recurrence* —In other words a reproduction of most of the superficial system in its original varicose state

(2) *Local recurrence* —This may occur as it does all too commonly at the point of the high resection

(3) *The appearance of minor varices* in an otherwise healthy limb In such legs the main trunks of the saphenous veins are still absent, but ugly small cosmetic veins reappear

(4) *The formation of " blow-outs* —This type of recurrence is due to a faulty deep venous system which eventually expresses itself by incompetent communicating veins

These are the four types of recurrence which we may expect after a careful stripping operation

Gross recurrence after the most carefully planned stripping may occur but is fortunately rare I would say that this is in the neighbourhood of 5 per cent

I present no statistics or figures to you, but we have every reason to remember the case of gross recurrence and I think that 5 per cent is a generous estimate after a 5-year period The main causes of such gross recurrence will be listed later in this chapter

Recurrences after inadequate operations are all too common, for instance, after a simple " top tie " with or without local ligations of the main trunk. Here

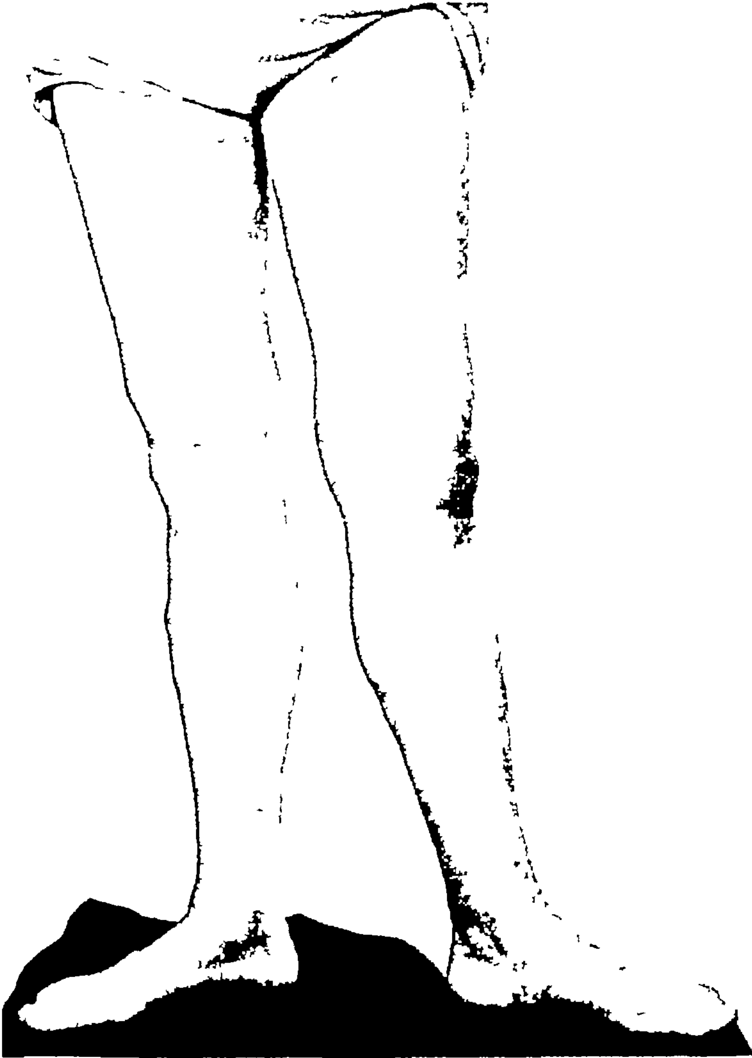


FIG 205.—This patient had attended two hospitals for three years, 3 operations in the groin and a fourth in the region of the knee had produced no improvement At operation it was found that the internal saphenous vein on both sides was quite undamaged by previous surgery Varicose vein patients are sometimes long-suffering and the presence of many scars is not necessarily indicative of a destruction of the saphenous vein

again statistics are most misleading In 1951 I circularized 600 patients for their report after a period of years since their operations In these cases " top ties " and scarification of the intima of the vein and sclerosant had been used The replies were highly satisfactory However, on examining a group of these patients, chosen haphazardly, at a later period, I was depressed by the gross recurrence rate

This however I repeat has not been my experience after examining groups of thoroughly stripped patients over the past eight years

Since the first edition of this manual appeared I have read many lists of statistics and have learned to mistrust all figures! They really can be made to prove anything and in the hands of enthusiasts can blind not only the reader but the originator himself to the truth

For this reason I feel that it is far better to leave percentages and figures on one side and simply to state that *gross* recurrence after a carefully planned operation performed in the way described in Chapter 8 is very rare *Minor* recurrences occur much more frequently but then the operation is performed essentially in order to prevent the progress of the disease In other words instead of the patient being inevitably worse he is better He has also avoided the complications of serious varices He has not suffered from phlebitis oedema, ulcer or eczema His symptoms have also been relieved. Even if some varices have re formed is this type of case to be classified as a failure or a recurrence?

Again the patient may have undergone several pregnancies since operation The varices have as a result, re appeared to some extent. The patient however has weathered the storm of pregnancy without leg complications Is she again a surgical failure?

You will see that in an inadequate manner I am trying to show to the reader how difficult it is for us to assess our results It is not possible to place all the post operative pictures into pigeon holes Previous editions of this book have been criticized for not giving details of our results I am afraid I just cannot do it, even in this edition written late in my " varicose life I can but repeat that at the time of writing to give the patient the best chance of avoiding recurrence it is necessary to undertake

(1) A careful planning of operation
(2) A meticulous top tie
(3) A complete stripping of the main trunks
(4) An excision of all obvious blow-outs

Nothing will make me give the neatly tabulated figures produced by some clinics This is not possible until we are agreed as to the *exact* meaning of the word recurrence

Let us now turn to the accepted causes of gross recurrence

Some causes of surgical failure—suggestions for their repair

Branches at the sapheno-femoral junction have been missed at the time of the original operation.—This is probably the commonest cause of recurrence after operation, and the repair of this type of failure is very often a difficult proposition since we may find very large and thin walled veins embedded in dense scar tissue In re-operating on such cases we may find that the normal anatomy is grossly distorted It is always wise to make a large incision and to see that this second approach is made above the primary incision whenever possible Remember that an incision made in the crease of the groin is never too high, and also remember the advice given by Wickham Lawes (1951) in which he points out the advantages of a " Z " incision in all obese subjects This incision is like the hockey-stick incision recommended by the author (Fig. 112) but has a further vertical extension



FIG 206—Recurrence after operation The arrow on the left leg points to the position of the scar of operation This type of surgery is not only useless but it makes subsequent operative procedure more difficult Note the use of Cellophane strapping on the right leg This strapping is cheap, sticks firmly, and allows the operator to note any bleeding which may be present It is free from the allergic responses sometimes associated with elastic adhesive plaster

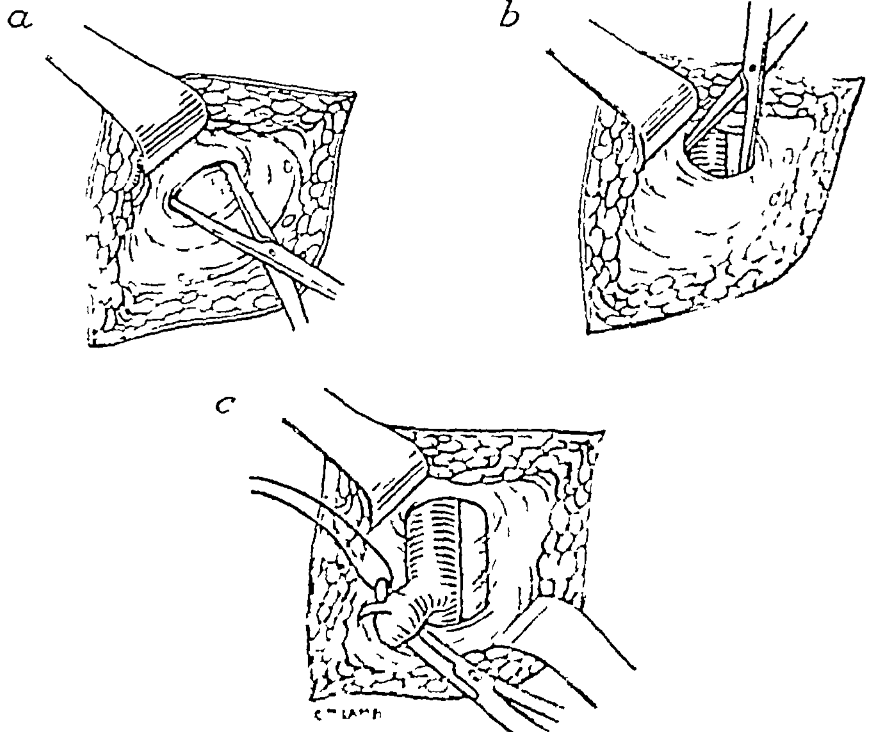


FIG 207—The exposure of the sapheno-femoral junction from above A normal groin incision is employed and the femoral vein is exposed as demonstrated in these drawings This difficult method is sometimes required when dealing with recurrences at the sapheno-femoral junction This is only necessary, however, when it is found impossible to strip the saphenous vein from below In rare cases of "second-hand surgery" a brittle saphenous bulb is better approached from above by the method depicted



FIG 208.—A high resection operation performed in 1947 The keloidal scar on the right leg is 45 centimetres long Immediate post-operative ambulation had been prescribed. Haematomas and sepsis caused 6 weeks invalidism in bed, followed by a nervous breakdown. This operation failed to secure the tributaries of the internal saphenous vein and was followed by a rapid recurrence of the varices. This type of surgery is still to be seen in our clinics in 1960!



FIG 209.—A severe recurrence of varices 18 months after operation. From the position of the scars and from the course of the tributaries of the internal saphenous vein, operation consisted in the possible section of the internal saphenous vein at some distance from the saphenous opening. These cases must be submitted to re-operation and stripped as described on pages 140–153



FIG 210 (*left*) —The long saphenous vein has been ligated too low, and its uppermost tributaries have not been ligated and severed Recurrence has taken place through anastomosing channels, as is shown This picture represents an all too common condition Subsequent operation is rendered difficult owing to scar tissue The groin wound must be re-opened and after the resection of tributaries the distal portion of the internal saphenous vein must be stripped

(*a*)

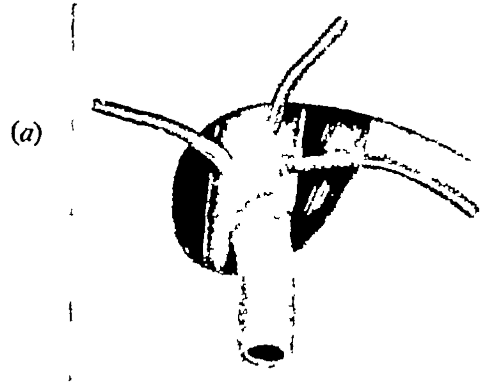
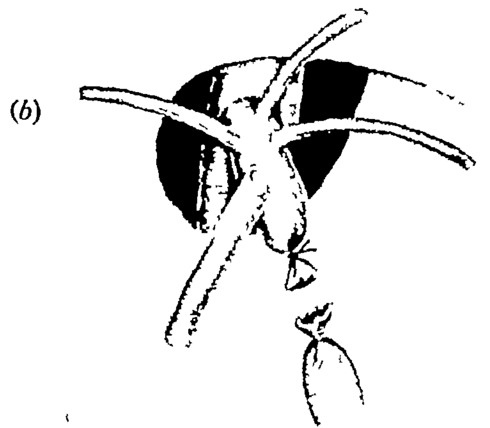


FIG 211 —(*a*) Illustrating a rare condition, in which the superficial circumflex iliac, the superficial epigastric and the superficial external pudendal veins enter directly into the femoral vein instead of into the uppermost portion of the long saphenous vein (*b*) Showing the long saphenous vein ligated too low The uppermost tributaries have been ignored, as well as the large lateral superficial femoral vein Recurrence in this case would be inevitable (*c*) Illustrating a fairly common mistake in which a large lateral superficial femoral vein has been mistaken for the long saphenous vein and ligated and divided The uppermost tributaries of the long saphenous vein have not been dealt with, and recurrence here can be expected

(*b*)



(*c*)



at right angles to the crease of the groin In rare cases it may become necessary when approaching the saphenous stump from above to open the femoral sheath and to dissect down to the saphenous opening. This may be the only possible method of approach when the tissue is dense (Fig. 207) In dissecting, keep close to the adventitia of the vein in order to find the plane which allows the fatty tissue to be swept aside.

This as we have said is the commonest type of recurrence whether of the internal or external saphenous vein It usually means that the original incision *has been made too low and that the junction of the superficial with the deep* venous system has not been adequately exposed Large joining branches as a result are not resected anastomosis takes place in the course of years and a new superficial system develops

Cases in which the internal saphenous vein has not been ligated at all and the internal accessory saphenous vein has been ligated in error —This error is unfortunately more common than it should be It should be noted in the history that these patients show no benefit after operation and that on examination the saphenous bulb is usually easily palpable The commonest causes of this error are too small an incision a misplaced incision or a lack of appreciation of the anatomy

Cases in which the external saphenous vein is either incompetent at the time of the original operation or has become so subsequently —When necessary the external saphenous vein should be dealt with at the time of the primary operation As explained previously the approach to the sapheno popliteal junction may be made best through an inverted thyroid type of incision There is nearly always a large communicating branch close to the junction which connects the internal and external saphenous systems As previously mentioned unlike many other writers I find that the recurrence rate after stripping the external saphenous vein is higher than that of its brother the internal saphenous vein This I feel sure is due to the vagaries of its termination

Cases which have received adequate treatment at the sapheno-femoral junction but in which blow-outs (incompetent communicating veins) in the lower third of the leg have either developed subsequent to the original operation or were not properly excised at the time of the original operation —As previously mentioned " blow-outs in the lower part of the leg should be excised at the time of the original operation when stripping has been performed

That very large group of cases which have not been submitted to a proper follow up after operation —There would be fewer recurrences if all patients were made to attend as a minimum once a year after operation They must be taught that varicose disease is a progressive condition and that the surgeon in many cases can but retard this progress Even after efficient surgical treatment subcuticular varices may gradually enlarge and fill for various causes The annual check up will allow these to be dealt with at an early stage A simple injection or an excision under local anaesthesia may be all that is necessary The re filling of these veins may be from incompetent communicating veins from normal veins or from an incompetence which has developed in the alternative venous system i e either internal or external saphenous

The repair of recurrent varicose veins

A very thorough examination is required before planning the necessary repair

(1) Is the top tie inadequate? Can by passes be detected? Is the bulb obvious when the patient coughs?

(2) Are the blow-outs obvious?

(3) Are the deep veins efficient? Are abdominal veins present, indicating an ilio-femoral thrombosis?

(4) Is the pelvis clear of obstructive tumours?

(5) Finally and rarely is there abnormal warmth of the skin over the varices and, furthermore will auscultation reveal a bruit suggestive of an arterio-venous fistula?

Having made a careful re assessment of the patient treatment can be planned for his relief

The surgical repair of the average case necessitates the further exploration of the wound in the groin. The presence of fibrous tissue may make this a difficult procedure, but the only certain way of knowing whether it is possible to help the patient is to re-open the original wound Having repaired the deficiencies if any in this area, the stripper may be introduced at the ankle or if that is not possible below the knee If local ligations have not been made to the main trunk of the saphenous vein one may be fortunate enough to extract the vein in one piece failing that it means that we have to be satisfied with serial stripping If the recurrence is from perforating veins in the course of the main trunk it may not be necessary to re open the groin wound. The stripper under these circumstances, may be passed from the ankle and when palpated in the groin may be exposed just below the original scar so that stripping may be performed in the manner already described. When the patient has had a previous high resection operation the passage of the stripper from the ankle upwards serves as a useful guide in finding the saphenous vein in the groin.

Again, remember that meticulous care is needed in varicose surgery and that speed has no place in this operation This fact may be impressed on the reader s mind by recalling the anecdote told of the famous surgeon Pirogoff who had the reputation of being one of the most rapid operators the world had ever seen He is said on one occasion with one clean sweep of the amputating knife in the space of a few seconds to have cut off the patient s leg, two fingers of the assistant who held the limb and the coat tails of a distinguished bearded foreign spectator!

We have not differentiated between the internal saphenous vein and the external saphenous vein in our descriptions of repairs since the procedure is similar —in other words as large an incision as is practicable at the " top tie " and the removal of as much vein by serial stripping as is allowed by the previous surgery In cases where even serial stripping is not possible we may have perforce to use the Mayo stripper (*see* page 138) This is a clumsy method, to be avoided wherever possible Frequently we are able to excise quite important lengths of vein by means of fine curved scissors through small incisions

At the annual check up the vast majority of patients require no surgery Mild recurrence can usually be dealt with by means of sclerosants or excision under local anaesthesia. Again, some mild cosmetic recurrences can best be dealt with by means of a reinforced nylon stocking which, whilst hiding some of the blemishes, will also offer gentle support to the limb

The purpose of these few comments on our "failures" is to stimulate interest in their repair and is offered in no critical spirit, since the author of these notes is humbled all too frequently by his own "failures" All recurrences after operation should be offered the most critical and careful examination In trying to discover the cause of "failure" be tolerant always of the mistakes of others, hoping that they may in their turn be equally tolerant of those that we have made ourselves

(1) Make certain where the recurrence has occurred Is it at the "top tie"? Are there by-passes and, if so, which vessel is mainly involved? This is determined by careful percussion of the varices as in Fig 78 Is the recurrence due to incompetent communicating vessels?

(2) If the recurrence is in the common situation of the sapheno-femoral junction, always pass the stripper from below before exposing this area The stripper wire will form a useful guide in the disarranged anatomy of the saphenous vein

(3) This is the one indication for a larger incision when sorting out the trouble in the groin

(4) Try whenever possible to go *above* the previous scar In rare cases opening the femoral sheath may be necessary in order to expose the saphenous bulb (*see* Fig 207)

(5) Remember that repair work is often unsatisfactory and let your prognosis be guarded

BIBLIOGRAPHY AND REFERENCES FOR CHAPTERS 6–11

Abraham, A J (1952) "New Operative Method of Causing Thrombosis in Varicose Veins" *Brit med J*, 2, 260

Allen, E V, Barker, N W, and Hines, E A, Jun (1947) *Peripheral Vascular Diseases* Philadelphia, Saunders

Atchley, R Q (1942) "Injection of Varicose Veins" *J Okla med Ass*, 35, 288

Atlas, L N (1943) "Hazards connected with the Treatment of Varicose Veins" *Surg Gynec Obstet*, 77, 136

Barber, T H T (1928) "The Technique of Injection for Varicose Veins" *Brit med J*, 2, 528

Barrow, D Woolfolk (1948) *Clinical Management of Varicose Veins* New York, Hoeber

Bartholomew, A E (1953) *The Treatment of Gravitational Ulcers by Physiotherapy* London, H K Lewis

Bauer, G (1946) "Thrombosis" *Lancet*, 1, 447

Beecher, H K, Field, M E, and Krogh, A (1936) "A Method of Measuring Venous Pressure in the Human Leg during Walking" *Skand Arch Physiol*, 73, 7

Beurier, F (1950) "Le Traitement des Ulcères de Jambe par les Eaux Thermales" *Acta Physioth Rheum Belg*, 6, 345

Biegeleisen, H I (1953) "The Chronic Character of Varicose Veins A Statistical Study—Surgery versus Sclerotherapy" *Medicina, Mex*, 33, 193

Bisgaard, Holger (1948) *Ulcers and Eczema of the Leg* Copenhagen, Munksgaard

Boyd, A M, and Robertson, D J (1947) "Treatment of Varicose Veins Possible Danger of Injection of Sclerosing Fluids" *Brit med J*, 2, 452

— *et al* (1953) "Major Venous Ligation in the Treatment of Post Phlebitic Sequelae" *Lancet*, 2, 113

— Catchpole, B N Jepson, R P, and Rose, S S (1953) "The Technic and Interpretation of Lower Limb Phlebography" *Ann Surg* 138, 726

Brodie, B (1946) *Lectures Illustrative of Various Subjects in Pathology and Surgery* London, Longmans, Green

Bull D C. and Hiatt, R. B (1948) Phlebectomy for Varicoses " *Surg Clin. N Amer* 28 545
Cockett, F B (1953) "The Practical Uses of Venography *Brit J Radiol*, 26, 339
Cole, J W and Holden W D (1950) " Polyethylene Rod Vein Stripper" *Surgery* 27 280
Cortes, S T and Rosas, A. P (1947) " The Surgical Therapy of Varices of the Lower Extremities by Inclusion of Foreign Bodies (Suture Threads) According to the Triana Cortes Technique. *Rev Fac Med. Bogota*, 15 629
Curwen, I. H M. and Scott, B. O (1952) The Ambulant Treatment of Complications Resulting from Varicose Veins and Allied Conditions. *Ann. Phys Med Lond* 1 17
Daseler E. H Anson, B J Reimann, A F and Benton, L. E. (1946) The Saphenous Venous Tributaries and Related Structures in Relation to the Technique of High Resection *Surg Gynec Obstet* 82, 53
Delater G (1926) " Fibrose Curative des Varices. *Pr méd* 34 693
Dodd, H (1940) Treatment of Varicose Veins. *Brit med J*., 1 869
— (1944) " Radical Operation for Varicose Veins. *Ibid*. 2, 814
— (1947) " The Diagnosis of Varicose Veins." *Post Grad, med. J* 23 427
— (1949) " Operation for Severe Varicose Veins During Pregnancy " *Lancet* 1 606
— (1953) " The Injection Treatment of Varicose Veins." *Med Pr* 229 119
Domanig, E. (1930) " Injektions behandlung der Varicen." *Zbl Chir* 57 935
Drummond, R. (1943) " Transfusion Reactions and Fatalities Consequent on Circulatory Overloading." *Brit med J* 2 319
Dulin, J W (1949) The Surgical Treatment of Varicose Veins." *J Iowa St med. Soc* 39 551
Edwards, E. A. (1934) The Treatment of Varicose Veins." *Surg Gynec Obstet* 59 916.
Faxon, H. H (1933) End Results in the Injection Treatment of Varicose Veins." *New Engl. J Med.* 208, 357
— and Barrow D W (1938) " End Results of High Ligation and Injection in the Treatment of Varicose Veins " *Surgery* 3 518
Fenney P W (1951) " Surgical Treatment of Varicose Veins A Survey of the Methods of Treatment with a Description of Intraluminary Stripping and its Results." *Ann. Surg* 133 386
Foote, R. R. (1944) *Varicose Veins Haemorrhoids and other Conditions their treatment by injection.* London Lewis.
— (1946) "Some Everyday Problems in the Treatment of Varicose Veins." *Practitioner* 156, 295
— (1946) " A Retractor for Varicose Vein Surgery *Brit med. J*., 2, 124
— (1947) The Bandage in Varicose Conditions." *Practitioner* 158 60
— (1948a) " High Resection of the Internal Saphenous Vein." *Ibid* 160 386
— (1948b) " Rough Neck Needle-Head for Treating Varicose Veins." *Lancet* 1 579
— (1948c) " Medical Uses of Polythene. *Ibid* 2, 396
— (1951) " Some Reflections on the Operative Results Obtained on 600 Varicose Limbs " *Practitioner* 166 244
— (1952) " Some Comments on the Repair of Failures in the Surgery of Varicose Veins " *Post Grad med J* 28 45
— (1953a) " Varicose Veins A Survey of the Modern Surgical Approach. *Med. Pr* 229 419
— (1953b) Surgical Treatment of Varicose Veins." *Lancet* 2, 784
Fratkin, L. B. and Jackes H L. (1951) " The Treatment of Varicose Veins. *Canad med Ass J*., 65 367
Garber N (1945) " Varicose Veins in the Lower Limb " *Clin. Proc Cape Town Post Graduate Med Ass* 4 200
— and Rand, W W (1948) A Criticism of Venous Competency Tests." *Clin. Proc*., 7 1
Gaugier L. (1929) " Le Notion de la Fragilité Veineuse " *Pr Méd*., 37 686
Génévrier J (1922) *Monde méd.* 32, 624
Glasser S T (1938) " A New Sclerosing Drug—Monolate " *Amer J Surg* 39 120
Hamilton, H G Pittam, R. F and Higgins, R S (1949) " Active Therapy of Varicose Veins in Pregnancy " *Sth med J* 42, 608
Hewer C. Langton (1947) " Intravenous Procaine *Brit med. J*., 2, 791
Higgins, T T., and Kittel P B (1930) Sodium Morrhuate in Treatment of Varicose Veins." *Lancet* 1 68

Hodge, G B, Grimson, K S, and Schiebel, H M (1945) "Treatment of Varicose Veins by Stripping, Excision and Evulsion" *Ann Surg*, **121**, 737
Holland, G A (1939) "Reactions from Sodium Morrhuate in Sclerosing of Varicose Veins" *Canad Med Ass J*, **41**, 262
Homans, J (1916) "Operative Treatment of Varicose Veins and Ulcers" *Surg Gynec Obstet*, **22**, 143
Howard, N J, Jackson, C R, and Mahon, E J (1931) "Recurrence of Varicose Veins after Injection" *Arch Surg, Chicago*, **22**, 353
Kilbourne, W J (1929) "Treatment of Varicose Veins of the Leg" *J Amer med Ass*, **92**, 1320
Kramer, D W (1940) "Manual of Peripheral Vascular Disorders" Philadelphia, Blakiston
Lawes, C H W (1951) "Some Points in the Management of Varicose Veins" *Med J Aust*, **1**, 637
Linde, Paul (1948) "Post-Thrombotic Varices" *Acta chir Scand*, **97**, 430
Linton, R R (1949) "Surgery of the Veins of the Lower Extremity" *Minn med*, **32**, 38
Luke, J C, and Miller, G G (1948) "Disasters Following the Operation of Ligation and Retrograde Injection of Varicose Veins" *Ann Surg*, **127**, 426
Lutton, A, and Grant, G H (1953) "Dangers of Ethanolamine Oleate Injection Treatment for Varicose Veins" *Brit med J*, **2**, 510
Lyall, D (1949) "Reactions Following Injection of Varicose Veins" *Amer J Surg*, **78**, 909
Mahorner, H R, and Ochsner, A (1936) "A New Test for Evaluating Circulation in the Venous System of the Lower Extremity Affected by Varicosities" *Arch Surg, Chicago*, **33**, 479
— — (1938) "The Modern Treatment of Varicose Veins as Indicated by the Comparative Tourniquet Test" *Ann Surg*, **107**, 927
— (1952) "New Vein Stripper" *New Engl J Med*, **246**, 340
Maingot, R H, (1932) *The Injection Treatment of Varicose Veins, Haemorrhoids, and other Conditions* London, Lewis
Massell, T B (1950) "Problem of Adequate Therapy for Varicose Veins A New Procedure" *West J Surg*, **58**, 112
McCutchen, G T (1946) "Varicosities of the Lower Extremity" *Amer J Surg*, **72**, 63
McPheeters, H O (1945) "Saphenofemoral Ligation with the Immediate Retrograde Injection" *Surg Gynec Obstet*, **81**, 355
— and Anderson, J K (1938) *Injection Treatment of Varicose Veins* Philadelphia, Davis
— and Rice, C O (1928) "Varicose Veins" *J Amer med Ass*, **91**, 1090
Medlar, R E (1949) "The Surgical Treatment of Varicose Veins" *Post Grad Med J*, **6**, 113
Mendelsohn, S N (1951) "Varicose Veins Complicating Pregnancy A Review of Recent Literature" *Ohio St Med J*, **47**, 41
Meyer, N E (1938) "Monethanolamine Oleate" *Amer J Surg*, **40**, 628
Miller, R T (1906) "Operative Treatment of Varicose Veins of the Leg" *Bull Johns Hopk Hosp*, **17**, 289
Moore, H D (1949) "A New Method of Venography with Particular Reference to its Use in Varicose Veins," *Brit J Surg*, **37**, 78
Moore, M D, and Knapp, G M (1942) "Varicose Veins" *Ann Surg*, **115**, 131
Nabatoff, R A (1953) "A Complete Stripping of Varicose Veins under Local Anaesthesia" *N Y St J Med*, **53**, 1445
Ochsner, A, and Garside, E (1934) "The Intravenous Injury of Sclerosing Substances" *Ann Surg*, **96**, 69
— and Mahorner, H R (1937) "The Modern Treatment of Varicose Veins" *Surgery*, **2**, 889
— and Mahorner, H (1939) *Varicose Veins* St Louis, C V Mosby Company
Ogilvie, W H (1945) "Some Applications of the Surgical Lessons of War in Civil Practice" *Brit med J*, **1**, 619
Paré Ambroïse (1579) Quoted by A Ritchie (1933) "Treatment of Varicose Veins during Pregnancy" *Trans Edinb obstet Soc*, **53**, 157
Payne, R T (1928) "Ambulatory Treatment of Varicose Veins" *Lancet*, **1**, 1189
Pearce M B (1943) "Varicose Veins A New Technique" *Surgery*, **14**, 901
Pratt, G H (1941) "Test for Incompetent Communicating Branches in the Surgical Treatment of Varicose Veins" *J Amer med Ass*, **117**, 100
— (1946) "New Treatment for Incompetent Valves in Varicose Veins" *J Amer med Ass*, **132**, 701
— (1949) *Surgical Management of Vascular Diseases* London, Kimpton
— (1949) "Arterial Varices a Syndrome" *Amer J Surg*, **77**, 456

Rakov P H. (1951) "A Simple Test for Occult Varicose Veins." *N Y J Med* 51 1405
Riddle, B S P (1940) *Injection Treatment* Philadelphia Saunders.
Sarma, P J (1941) "Recurrence of Failures following Modern Treatment of Varicose Veins. *Surgery* 10 752.
Scott H. W Jun. and Roach J F (1951) Phlebography of the Leg in the Erect Position." *Ann. Surg.*, 134 104
Sedgwick, C. E. (1949) "Management of Varicose Veins of the Lower Extremity" *Surg Clin Chicago* 29 887
Seiro V (1938) Ueber Blutdruck und Blutkreislauf in den Krampfadern der untered Ex termitaten." *Acta chir scand.*, 80 41
Shelley H. J (1939) "Allergic Manifestation with Injection Treatment of Varicose Veins *J Amer med Ass* 112, 1792.
Sherman, R. S (1949) "Further Findings Based on Anatomic and Surgical Dissection" *Ann. Surg* 130 218
Sicard, J A. and Gaugier L. (1931) *Le Traitement des Varices par les Injections Locales Sclerosantes* 3rd ed. Paris Masson.
Solomons, E. (1950) Treatment of Varicose Veins in Pregnancy Critical Survey of Injection Treatment Based on 600 Cases Treated at Rotunda Hospital." *Irish J med Sci. Aug* p 353
Stalker L. K. and Heyerdale, W W (1940) "Recurrence of Varicosities following Treatment." *Proc Mayo Clin.* 15 350
Sullivan, J M., and Merdinger W F (1951) "Vein Stripping Versus Multiple Ligations." *Wis med J.*, 50 357
de Takáts, G (1930) Ambulatory Ligation of the Saphenous Vein." *J Amer med Ass* 94 1194
— and Quillin, L. (1933) Ligation of the Saphenous Vein. *Arch. Surg Chicago* 27 72.
— and Fowler E. F (1951) "The Management of Varicose Veins of the Lower Extremities." *Surg Clin. Chicago* 31 1463
Tanner E. K. and Field, W H. (1927) Operative Treatment of Varicose Veins. *Surg Clin. N Amer* 7 1103
Tavel, E (1912) Die Behandlung der Varicen durch die künstliche Thrombose *Dtsch Z Chir.*, 116 735
Thompson, W (1950) "A Modified Mayo Vein Stripper" *Lancet* 2, 173
Trendelenburg, F (1891) "Ueber die Unterbindung der Vena saphena magna bei Unterschenkelvaricen." *Beitr klin Chir* 7 195
Truman, S R (1942) "Monoethanolamine (Monolate) *J Lab clin Med* 27 586
Vaughn, A M. Annan, C. M and Caserta, J A (1952) Modern Trends in Treatment of Varicose Veins" *Surg Clin. N Amer* 32, 287
Warren R., White, E. A., and Belcher C. D (1949) Venous Pressures in the Saphenous System in Normal Varicose and Postphlebitic Extremities. *Surgery* 26 435
Warwick, W T (1945) Varicose Veins." *Med Pr.*, 214 22.
Webb A Jun. (1953) Some Technical Considerations in the Operative Treatment of Varicose Veins. *Annals of Surgery* 137 778
— (1951) "A Simplified Vein Stripper" *Surgery* 29 276.
Weber L. (1885) Treatment of Hydrocele and Varicose Veins by Carbolic Acid Injections *Med Rec N Y* 28 649
White, E A., and Warren, R. (1949) "The Walking Venous Pressure Test as a Method of Evaluation of Varicose Veins. *Surgery* 26 987
Wilson, M G (1953) "A Method of Treatment for Varicose Veins" *Lancet* 1 1273
Wright A D (1940) Treatment and Complications of Varicose Veins. *Brit med J* 1 665 699
Wright, R B (1949) "Some Observations on Recurrence of Varicose Veins After High Ligation Operation." *Glasg med J* 30 447
— (1950) "The Treatment of Varicose Veins of the Lower Limb with Particular Reference to the Location of the Communicating Veins." *Ibid.*, 31 351
Yeomans F C (1939) *Sclerosing Therapy* London Baillière, Tindall and Cox.
Zaidman, M. Vilanova, D L., and Pataro V F (1954) "Tecnica resultados de la fleboextraccion." *Angiologia* 6, 29
Zimmerman, L. M (1934) Allergic like Reaction from Sodium Morrhuate." *J Amer med. Ass* 102, 1216.
Zollinger R. W and Gilmore H M (1952) "A New Intraluminal Vein Stripper" *Surgery* 32 846

ADDITIONAL REFERENCES

Allen, E V, Barker, N W, and Hines, E A (1955) *Peripheral Vascular Diseases*, 2nd ed Philadelphia, Saunders

Begg, A C (1954) "Intraosseous Venography of the Lower Limb and Pelvis" *Brit J Radiol*, **27**, 318

Biegeleisen, H I (1937) "Fatty Acid Solutions for Injection Treatment of Varicose Veins Evaluation of 4 New Solutions" *Ann Surg*, **105**, 610

Boyd, A M, Catchpole, B N, Jepson, R P, and Rose, S S (1953a) "Major Venous Ligation in the Treatment of Post-phlebitic Sequelae" *Lancet*, **2**, 113

— — — — (1953b) "The Technique and Interpretation of Lower Limb Phlebography" *Ann Surg*, **138**, 726

Cockett, F B (1953a) "Pathology and Treatment of Venous Ulcers of the Leg" Thesis, London

— (1953b) "The Practical Uses of Venography" *Brit J Radiol*, **26**, 339

— (1954) "Abnormalities of the Deep Veins of the Leg" *Post Grad med J*, **30**, 512

— (1955) "Pathology and Treatment of Varicose Ulcers of the Leg" *Brit J Surg*, **43**, 260

— and Jones, D E E (1953) "The Ankle Blow-out Syndrome A New Approach to the Varicose Ulcer Problem" *Lancet*, **1**, 17

Dodd, H (1949) "Operation for Severe Varicose Veins during Pregnancy" *Lancet*, **1**, 606

— and Cockett, F B (1956) *The Pathology and Surgery of the Veins of the Lower Limb* Edinburgh, Livingstone

— and Payling Wright, H (1959) "Vulval Varicose Veins during Pregnancy" *Brit med J*, **1**, 831

Foote, R R (1952) Film, "Surgery of Varicose Veins" B M A Film Library

— (1953) "Surgery of Varicose Veins" *Lancet*, **1**, 858

— (1957) "Varicose Vein Problems in General Practice" *Practitioner*, **179**, 59

— (1960) "Stripping of Varicose Veins" *Brit med J*, **1**, 1737

— and Fredman, M (1955) "Prevention of Bleeding during Vein Stripping" *Lancet*, **2**, 1302

Fratkin, L B, and Jackes, H L (1951) "The Treatment of Varicose Veins" *Canad med Ass J*, **65**, 367

Linton, R R (1949) "Surgery of the Veins of the Lower Extremity" *Minn med*, **32**, 38

Lofgren, K A, Ribisi, A P, and Myers, T T (1958) "An Evaluation of Stripping versus Ligation for Varicose Veins" *A M A Arch Surg*, **76**, 310

McPheeters, H O (1956) "Treatment of Varicose Veins, 25 Year Reflection" *Minn med*, **39**, 271

Medical Defence Union (1956–7) Annual Report, p 44

Muir, I F K, Mucklow, E H, and Rains, A J H (1954) "Venography and the Approach to Varicose Veins" *Brit J Surg*, **42**, 276

Myers, T T (1955) "Varicose Veins" in *Peripheral Vascular Diseases*, 2nd ed, by Allen, E V, Barker, N W, and Hines, E A Philadelphia Saunders

— (1957) "Results and Technique of Stripping Operation for Varicose Veins" *J Amer med Ass*, **163**, 87

Pearce, D J (1957) "The Roll of Posture in Laminectomy" *Proc R Soc Med*, **50**, 109

Walker, A J, and Longland, C J. (1950) "Venous Pressure Measurement in the Foot in Exercise as an Aid to Investigation of Venous Disease in the Leg" *Clin Sci*, **9**, 101

CHAPTER 12

"VARICOSE" ULCERATION HAEMORRHAGE

SEVERE varicose veins may be present without giving rise to symptoms or complications I am often amazed to hear My legs never worry me when faced with a patient with the most hideous varices I sometimes wonder whether they have grown so accustomed to the heavy aching that they speak the truth On the other hand, many make no complaint out of fear of advice for surgical treatment—and who can blame them?

The common complications of severe varices may be listed as follows

(1) Superficial thrombophlebitis
(2) Haemorrhage
(3) Changes in the skin
(4) Pruritus
(5) Aching
(6) Cramp
(7) Muscle atrophy
(8) Flat feet
(9) Swelling.
(10) Psychological complications
(11) Eczema and ulceration

Superficial thrombophlebitis

This complication is sufficiently common and important to be dealt with in Chapter 13 in a fuller discussion

Haemorrhage

This is a common complication The bleeding may be subcutaneous and merely lead to severe bruising, or it may be open and give rise to a sudden and alarming flow Although haemorrhage may be spontaneous some form of trauma is the usual antecedent Cases of death from such haemorrhage are frequently reported Two such cases receive mention by Dr W W Woodward (1958) He very rightly calls attention to the fact that all patients with severe varicose veins should be instructed in how to deal with this complication Direct pressure to the *elevated* limb is so often omitted and it is not rare to find that a tourniquet has been applied between the heart and the hole! Remember also that the small fragile varix on the point of rupture can be made safe by the injection of a small dose of sclerosant. The needle must be inserted through healthy skin at a distance to the vein to be injected

Changes in the skin

Yellow brown patches of pigmentation may occur These are usually situated around the ankle area. This is said to be due to a deposit of haemosiderin Melanin deposits may also occur as a result of scratching Petechiae may also be noticeable Long standing varices may also cause the limb to become hairless and also affect the colour of the foot causing mild cyanosis

Pruritus

The varicose limb often itches sufficiently to cause scratching Proper support or the stripping of the varices causes this complication to disappear

Aching

Heavy, aching, and tired limbs are frequently present when the superficial varices are incompetent These symptoms are worse during menstruation and pregnancy The presence of incompetent communicating veins increases the discomfort considerably

Cramp

This complication has already been discussed on page 77

Muscle atrophy

The senile varix is often associated with poor calf muscles The spindle-shaped leg with a poor " muscle pump " is a common finding

Flat feet

In the presence of poor muscle development, flat feet are common The reader will notice that many of the pictures shown of severe varicose disease also demonstrate this point (Figs 103, 115)

Swelling

Even the most gross incompetence of the saphenous vein produces very little oedema *Marked swelling is always due to involvement of the deep veins and their communicators* Mild swelling, worse in the evenings, is, however, common with the varix This disappears after stripping

Psychological complications

Women are apt to get morbidly depressed as a result of their ugly varices Their outlook on life can be changed once their limbs become shapely once again! This shows that operation can be justified on cosmetic grounds alone if health is being affected by their condition

Eczema and ulceration

There are many who claim that incompetent superficial veins do not and cannot produce ulceration They argue that multitudes of sufferers from severe varices never ulcerate In a practical manual there is no place to present the various pros and cons, but I append an adequate bibliography for those interested in argument I would prefer to say that over many many years I have healed many ulcers by removing the superficial varices only, without any additional treatment I feel that the true " varicose ulcer " is still a definite entity Needless to say it is unfortunately far less common than the *venous ulcer* secondary to deep vein involvement The varicose ulcer appears in a slim limb and shows the following characteristics

Those ulcers directly due to varicose veins present in the limb are superficial and never penetrate down to the deep fascia The ulcers are usually about an inch in circumference Their most constant position is a few inches above the medial malleolus and the presence of feeder veins to the ulcerated area is usual

These ulcers are associated with but slight oedema but pigmentation is common. Secondary infection of the ulcer is unusual but eczema, either from scratching or from an allergic response to fungoid infections may be present. The response of these ulcers to treatment is good

Stripping the superficial varices cures such an ulcer On occasions at the time of stripping a few incompetent communicating veins have been felt, and these have been resected It is difficult to say whether a true varicose ulcer can be produced by the superficial system defects only I feel that in most cases a few incompetent communicating veins are also at fault Let us however reserve the term varicose ulcer for the type I have described which reacts to the ablation of the superficial system of veins As a rule trauma and often a few incompetent communicating veins must also be held responsible for the development of the ulcer Fig 214 is fairly typical of varicose ulceration

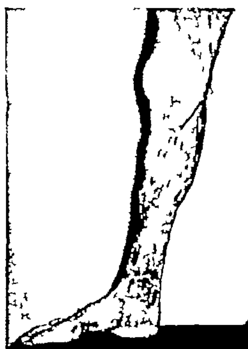


FIG 214—A typical varicose ulcer The internal saphenous vein is quite incompetent The foot is of good colour and the ankle is slim. Massage, exercises and compression treatment will heal this ulcer after which stripping of the superficial varices is to be recommended.

We are told that at St Thomas s Hospital 53 per cent of the patients with leg ulcers gave no history of a previous deep vein thrombosis This is indeed supporting evidence regarding what we have already said about the varicose ulcer as a special entity

The limb should receive compression and physiotherapy (*see* Chapter 16) before operation, and stripping should be delayed wherever possible until the ulcer has been healed and the skin area rendered sterile

These then are the main complications of the varix Probably the two most important are thrombophlebitis and disfigurement The average woman, however would prefer many attacks of phlebitis rather than hear her next-door neighbour criticize her ugly legs!

REFERENCE

Woodward, W W (1958) " Fatal Haemorrhage from Superficial Varix." *Brit med J* 2, 166

CHAPTER 13

SUPERFICIAL THROMBOPHLEBITIS

THE PATHOLOGY of venous thrombosis is discussed in Chapter 14 Thrombophlebitis of the superficial veins of the leg is a common condition, which many years ago was treated with prolonged immobilization of the affected limb in bed Fortunately this does not happen now that the pathology is better understood Dickson Wright, a quarter of a century ago, pointed out that a stagnant circulation would become more static by bed-rest, and that as a result, clotting would be encouraged with the greater risk of embolism It takes a long time for the truth to see the light of day, but as far as thrombophlebitis is concerned, we are now able to relegate the static treatment to the historical chapter

Superficial thrombophlebitis may affect

(1) Varicose veins
(2) Normal veins

The primary idiopathic recurrent type of phlebitis which affects normal veins is far, far rarer and will be considered later

SUPERFICIAL THROMBOPHLEBITIS OF VARICOSE VEINS

Causes

(a) Idiopathic (no cause can be found)
(b) Stasis of the circulation from bed-rest or immobility of the limb
(c) Constrictions applied to the limb, such as tight garters
(d) Trauma Injury to a varicose vein will damage the intima and cause clotting This trauma may come also from vein puncture
(e) Secondary to fevers, such as influenza, typhoid, etc
(f) As a terminal condition secondary to cardiac or neoplastic disease
(g) From chemical irritants, an example being the injection of a sclerosant or during intravenous therapy
(h) Secondary to a septic focus

Furthermore, *suppurative thrombophlebitis* may occur in the feeding vein of an abscess This is becoming a rarity thanks to the use of antibiotics

These are but a few of the common causes of phlebitis All patients suffering from this condition need to give a thorough history and to be examined carefully As an example, a patient recently consulted me with a thrombophlebitis involving the main trunk of the internal saphenous vein She could give no cause for the sudden appearance of this condition Examination showed her to have a haemoglobin of 50 per cent Further examination demonstrated a bleeding duodenal ulcer This case serves to show how necessary it is to *look for a cause elsewhere*

The signs and symptoms

General

The patient may suffer from malaise and pyrexia if the attack is acute

Local

Superficial thrombosed veins can be easily felt The skin over the veins is usually red if the condition is at all acute The veins feel like cords and are tender to touch In other words the condition is obvious and the only important signs to look for are whether

(a) The phlebitis is affecting small radicles only or

(b) The main trunk of the internal or external saphenous veins are involved

If so does the thrombosis extend to the termination of the trunk? The reasons for these observations will be obvious when treatment is discussed

Treatment

(1) Of small radicles

(2) When the trunks of either the internal or external saphenous veins are involved

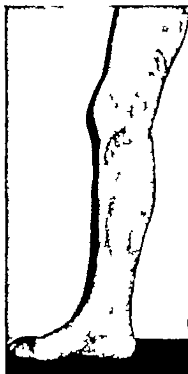


FIG 215 —This photograph shows the typical appearance of resolving acute superficial thrombophlebitis. The skin overlying the hard thrombosed vein is discoloured and local tenderness is still present The patient is, however ambulant and afebrile The internal saphenous vein is thrombosed as far as the sapheno-femoral junction For this reason, a high resection operation is not possible

Treatment of small radicles

First, look for a cause and if one is found treat it

Cover the inflamed patch with a square of Elastoplast or apply an Elastoplast bandage from toe to knee if there are several areas of inflammation Reassure the patient and if possible keep her at work. Explain that sluggish blood is bound to clot at some time and that there is no risk of detachment of the thrombus

Exception to the treatment outlined is indicated if a very large mass of varices is involved Under these exceptional circumstances it is better to use a dry elastic bandage so that the condition may be kept under observation Exceptionally excision of the mass may be called for and this is discussed under the surgical treatment later in this chapter (page 223)

There would obviously be far less phlebitis if varices were stripped when operation was called for Owing to the shortage of hospital beds this ideal of preventive treatment is difficult, however

When the main trunks are involved

The ideal method is to be in the position to treat this condition as a surgical emergency If thrombosis is not felt quite definitely in the groin an immediate high resection of the internal or external saphenous vein is all that is required This surgical treatment will be discussed later

If surgery is not possible firm bandaging along the lines suggested in Fig. 216 is the only alternative This is a method, however which I must repeat is a very

poor alternative to surgery It is difficult to apply and gives poor results In any case, if surgery is not practicable this is the only alternative

General treatment consists in the giving of analgesics and sedatives and in the control of the inflammation Antibiotics are permissible if the patient is pyrexial It is doubtful, however, if their use materially affects the course of the disease itself As already mentioned, the inflammation is a sterile process Samples of blood from the affected veins are free of organisms The causal condition,

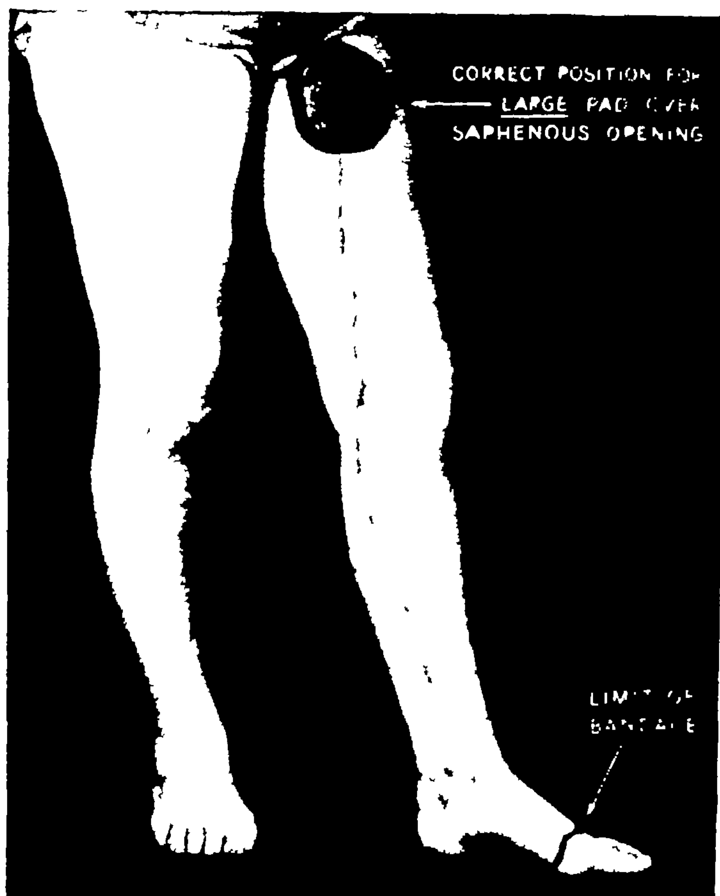


FIG 216 —The ambulatory treatment of superficial thrombophlebitis affecting the internal saphenous vein Note that a large chamfered Sorbo pad is being used If this pad is too small it may cause damage An Elastoplast or a two-way-stretch bandage may be used in this treatment, the latter having the advantage of being removable at night

however, may well be a streptococcal infection of the throat, or some similar sepsis, and for this reason antibiotics may be necessary During the early stages when pyrexia is present a short period of bed-rest may be indicated Movements of the limb (*see* Chapter 16) should be encouraged during this bed-rest period Local applications are of little value, but infra-red radiations or hot fomentations may help the pain, and also help to satisfy the patient Any other form of local therapy seems to be of little use

Dodd and Cockett (1956) recommend the application of glycerine and belladonna I have yet to be satisfied that any local application is of therapeutic value

In the treatment of all types of thrombophlebitis *ambulation* is essential This may be modified to active exercise in bed in the acute stages At all costs however the sluggish circulation must not be allowed to become more static than it already is In 1960 it seems unnecessary to point out what Dickson Wright and others preached 25 years ago but my experiences show that on rare occasions it *is* still necessary

Much has been written regarding the advantages of giving Butazolidin in acute phlebitis Sigg (1955) and Küng (1955) amongst others write in its support I have found little value if any in this drug Aspirin in my opinion has more advantages and certainly fewer disadvantages than Butazolidin, which can, and often does cause grave constitutional results There are many who do not agree with me, however and Messrs Soldenhoff and Ross (1960) present an interesting series of cases

Summary

(1) Superficial thrombophlebitis is a painful local condition and rarely gives rise to a pulmonary embolus

(2) The primary aim of treatment is to prevent venous stasis

(3) Surgical treatment is only indicated in ascending thrombosis affecting the main saphenous trunks and is limited to high resection only

(4) Any further surgical treatment is far better left until the inflammation has completely subsided

The surgical treatment of superficial thrombophlebitis

We have already discussed the fortunately rare occasion when a huge mass of localized thrombosed varix is best excised Since this mass is sterile and since its resolution may take weeks there are occasions when the removal of the mass is essential in order to get the sufferer back to work quickly Ten days after such an excision he may well be fit once again Leaving the absorption of the clot to Nature may on the other hand take six weeks or more

Surgery is further required in the acute ascending phlebitis affecting the main trunk of the internal or external saphenous vein Here we have three schools of thought There are those who recommend

(a) The high resection operation or

(b) The high resection operation with the addition of the injection of sclerosant to the distal portion of the vein, or

(c) The high resection operation in conjunction with the stripping of the distal portion during the acute stage

My own views are that if faced with a patient suffering from acute ascending phlebitis the proper surgical treatment is to open the groin under local anaesthesia and to inspect the sapheno-femoral junction If it is not thrombosed at its union with the femoral a careful high resection only should be performed If the junction shows that it is thrombosed we are too late, and the wound should be sewn up without interfering with the veins No harm has been done Treatment after this consists of bandaging and ambulation I have found this to be the best treatment since it allows the patient to return to work, as a rule, within one week. Nature produces a good thrombosis of the distal veins after this operation and *at*

a later date a careful stripping can be done up to the groin under satisfactory conditions Sometimes, however, Nature makes such a good job that this subsequent stripping may not be required

There are others (Dodd and Cockett, 1956) who inject sclerosants into the distal segment at the time of operation I do not like this, since the ideal is to strip at a later date Sclerosant injections will only serve to stick the vein more firmly in the leg and to make subsequent stripping even more difficult Furthermore, the injection during the inflamed period can only increase the pain and inflammation Let Nature do the work after the " top tie " and if she does not make a good enough job of it, we can always strip later

Stripping the distal varices during the acute attack does not appeal to me I cannot see why there is any harm in waiting—especially since subsequent stripping in a few cases may well not be necessary However, there are authorities in the U S A who advocate this procedure Having had no experience, I cannot criticize, but I just feel it is not right!

Thrombophlebitis migrans or recurrent idiopathic thrombophlebitis

Thrombophlebitis migrans is characterized by a thrombophlebitis occurring without any antecedent affection of the veins The name is admirably suited to the condition, since it is essentially migratory, the lesions presenting themselves haphazardly regarding both time and position Although by no means a rarity, this condition is relatively uncommon, those particularly interested in the subject should read Barker's article (1934), which presents a résume of most of the writings on recurrent idiopathic thrombophlebitis up to the time of its publication The condition has been well recognized for a century, but little more is known about it at the present time than when it was first discovered This statement is well supported by the very thorough and excellent article by Baron (1956) For an up-to-date summary, I recommend the reader to consult this article, since owing to the relative rarity of the condition it can but find a small place in this manual

These recurrent venous clottings in the absence of any obvious activating factors have naturally produced many interesting theories of aetiology, none of which has been proven Among the aetiological factors which have been most discussed are those ranging from Paget's (1866) original comment that either gout or a gouty diathesis is usually found in association with the condition to the more recent theories of streptococcal infection and focal sepsis It is of interest that a gouty inheritance has been traced in many of the cases the author has investigated. A search for focal sepsis in tonsils, teeth, prostate, cervix uteri and middle ear must always be carried out, since infection in these areas is found to be commonly associated with the disease and part of the essential treatment will consist of eradicating these points of focal sepsis The condition is said to be commoner in men than in women and tends to affect those of middle age rather than those at the extremes of life Unlike thromboangiitis obliterans, it is not more common amongst Jews Cultures taken from excised portions of veins have been found to be quite sterile It has been noted by Moorehead and Abrahamson (1928) that thrombosis of the veins of the internal viscera may be associated with thrombophlebitis migrans Patients who have suffered severe injuries with an extravasation of blood causing an outpouring of platelets may well develop thrombophlebitis

migrans, especially if the patient has a thrombophilic tendency The presence of varicose veins does not seem to predispose to this disease

Clinical features

The general clinical signs and symptoms of the condition are well summarized by Harkavy (1924) as follows

(1) A tendency to involve superficial veins especially of the upper and lower extremities.

(2) A decidedly segmental distribution with healthy vein intervening.

(3) A progressive spread which is usually accompanied by moderate fever

(4) The lesions have the appearance of fusiform nodular masses which are sensitive to touch Oedema may or may not occur

Added to the above summary the association of this condition with thrombosis of the veins of the internal viscera, upon which Moorehead and Abrahamson (1928) lay particular stress should be mentioned

Pathology

Pathologically we have found that the condition usually affects small and medium-sized veins The degree of inflammatory reaction in the vein walls is often extensive and is frequently associated with periphlebitis

Histologically the picture of thrombophlebitis migrans is indistinguishable from that of thromboangiitis obliterans It is, in fact, sometimes associated with the condition or with some other arterial changes

Treatment

General

The patient requires reassurance and a sanguine outlook, because he is generally afraid of embolism and has the possibility of sudden death or of a long period of invalidism in his mind He should be made to understand that the ultimate prognosis is favourable although in some cases the disease may take a prolonged course. Rest in bed for the first few days at least is advised. Temperature, pulse and respiration rates should be taken 4-hourly and the patient should be kept in bed until the temperature has been at a steady subnormal for a few days If at this time the thrombophlebitis is limited to superficial veins and the temperature remains normal, the patient is allowed up in his bedroom and the venous circulation is supported by the application of Elastoplast, elastic or *crêpe* bandages.

Medicinal

Antibiotics find but a small place in treatment, since the blood in the inflamed veins is found to be sterile In the early stages of the disease however antibiotics may be given a short trial in the hope that they may deal with a septic focus if any A few days on penicillin in the early stages if pyrexial should be considered It is possible that steroid therapy may be of some value

Treatment of incidental sepsis

During the foregoing treatment obvious sepsis should be dealt with for instance, a urinary infection can be treated and gingivitis and gum pockets can

be dealt with When the disease is healed or is in a quiescent phase, more radical measures designed to remove focal sepsis can be undertaken

Vaccine therapy

With treatment on the above lines, the disease rarely continues with recurring attacks of thrombophlebitis persisting over several months, as not infrequently happened in the past If, however, a migrating phlebitis continues in spite of treatment a course of autogenous vaccine is advised Haemolytic streptococci from the throat are sometimes considered to be causal, and autogenous vaccines prepared from this area may be of help The recommended dose is 0 1 millilitre of a vaccine concentrate of 500,000,000 organisms per millilitre The dosage may be increased by 0 1 millilitre to a maximum dosage of 1 0 millilitre An excessive reaction, either general or local, at any stage of treatment will call for a decrease in dosage Allen, Barker and Hines (1947) particularly claim that this therapy has been helpful in a number of their own cases

Abstinence from tobacco

The patient is advised to give up tobacco smoking altogether It is of little or no advantage to cut down smoking because the bad effects of tobacco smoking, if they exist, are due to hypersensitivity and not to excess Confirmation of this point has been recently given by Oldham of Liverpool (1953) who points out that the limitation of smoking has given relief to most of his patients suffering from superficial phlebitis associated with arterial disease Many found that just one cigarette was enough to bring on another attack of phlebitis

Surgical

When the disease is associated with varicose veins a high resection of the internal saphenous vein may be indicated

Anti-coagulant therapy

Anti-coagulants may be needed in the presence of embolism This complication is common According to Barker (1934, 1936), some 12 per cent of patients may suffer from embolism, and this is supported by Fischer (1946), who reports 23 cases of embolism in 114 cases There were 5 deaths in this series

Anti-coagulants are also used in the treatment of the thrombophlebitic episode Encouraging reports are given to us by Tulloch and Wright (1954) Shapiro (1953) reports good results with anti-coagulant therapy and states that failure to react to the treatment may be diagnostic of an underlying undiagnosed malignancy

Foley, McDevitt, Symond and Wright (1955) present us with some most impressive figures as to the advantages of anti-coagulants in the therapy of this condition

Summary

(1) A cause for the recurrent phlebitis must be looked for carefully Septic foci must receive attention

(2) Arterial disease so often associated must be excluded

(3) Malignant disease is sometimes present

(4) Anti-coagulant therapy has given good results in the hands of many authorities

BIBLIOGRAPHY AND REFERENCES

Allen, E. V Barker N W and Hines, E. A. Jun. (1947) " Peripheral Vascular Diseases Philadelphia Saunders.

Barker N W (1934) " Recurrent Idiopathic Thrombophlebitis of Legs." *Med. Clin. N Amer.*, **18** 597

— (1936) " Thrombophlebitis " *Proc Mayo Clin.*, **11** 513

Baron, J H (1956) " Idiopathic Recurrent Thrombophlebitis. *Practitioner* **177** 712.

Dodd, H., and Cockett, F B (1956) *The Pathology and Surgery of the Veins of the Lower Limb* Edinburgh Livingstone.

Fischer E. H (1946) Thrombophlebitis Migrans " *J Kans med Soc.*, **47** 245

Foley W T McDevitt, E. Symond, C. and Wright, I S (1955) Further Experience with Long Term Anticoagulant Therapy " *Arch. intern Med.* **95** 497

Harkavy J (1924) " Phlebitis and Thrombophlebitis Migrans." *Med J Rec.*, **120** 64

Küng, H L. von (1955) " Wirkung von Butazolidin auf eine Artifizielle Sterile Thrombophlebitis in Tierversuch." *Schweiz med. Wschr* **85** 262

Moorehead, T G., and Abrahamson, L. (1928) " Thrombophlebitis Migrans." *Brit med. J.*, **1** 586.

Oldham, J B (1953) " Aetiology of Vascular Disease." *Brit med J.*, **2**, 628

Shapiro S (1953) " Long Term Anticoagulant Therapy *Med Clin N Amer* **37** 659

Sigg, K. (1955) Zur Behandlung der Venenthrombose mit Butazolidin." *Schweiz med. Wschr* **85** 261

Soldenhoff R. de and Ross A H M (1960) Superficial Thrombophlebitis Treated with Phenylbutazone " *Practitioner* **185** 321

Tulloch, J and Wright, I S (1954) Long Term Anticoagulant Therapy " *Circulation* **9** 823

CHAPTER 14

DEEP VENOUS THROMBOPHLEBITIS, PULMONARY EMBOLISM AND ANTI-COAGULANT THERAPY

THROMBOPHLEBITIS

THROMBOPHLEBITIS affecting both the superficial and deep venous systems of the leg is a common condition Inflammation of the deep veins is especially important, since neglect in treatment during the acute stage leads so commonly to chronic venous insufficiency It is this condition of the indurated leg which fills our clinics with thrombotic ulcers It is, therefore, all-important to have a proper understanding of the aetiology of the condition and its immediate treatment in the early stages The terms thrombophlebitis and phlebitis are interchangeable, but the former is more descriptive of the pathological changes During the past few years, the clotting of the blood in veins has been described under two categories (a) *phlebothrombosis,* which implies the presence of a loosely attached clot unassociated with inflammation, and (b) *thrombophlebitis,* which implies the presence of clots firmly attached to an inflamed vein wall Clinically this division into two groups is not of great value, since phlebothrombosis may occur in the presence of thrombophlebitis and will in any case be associated eventually with inflammation owing to the secondary reaction caused by the loose clot situated in the lumen of the vein When pulmonary embolism is discussed it will be seen that phlebothrombosis may come silently, like a thief in the night, and that the loosely attached clot may cause a dramatic and fatal embolism with few, if any, warning signs and symptoms

Aetiology

In the aetiology of varices there are many "varicosity factors", similarly, with regard to thrombophlebitis there are many "thrombotic factors" The increasing knowledge in these spheres makes the subject all the more interesting and the field for research all the more inviting This research has received much consideration in the past and it is interesting to note that John Hunter (1793) called attention to the fact that thrombosis had phlebitis as a factor in its causation One hundred years later Hayem (1889) recognized the importance of platelets in thrombosis. Baillie (1793) and Laennec (1819), amongst others, called attention to the importance of stasis of the blood as a further factor in aetiology But of the many factors which are thought to predispose to venous thrombosis very few are of vital importance. The following, however, are worth our consideration.

(1) Stasis and slowing of the venous blood stream

(2) Injuries to the tissues

(3) Changes in the composition of the blood, such as hyperglobulinaemia, hyperproteinaemia, polycythaemia, haemorrhage and anaemia

(4) Infectious diseases such as typhoid fever and local toxins such as those from fungus infection

(5) Cardiovascular disease.
(6) Obesity
(7) Debilitating disease such as malignancy
(8) Age
(9) Tobacco
(10) Familial causations

The above are some of the factors, which may singly or in conjunction with each other cause a clotting of the blood It is thought that a change in the clot ting factor is produced by a high platelet count and evidence in favour of this theory is advanced by Evans and Boller (1946) and also by Krumbhaar and Ehrich (1942)

Venous stasis

This is without doubt the most important single factor in the production of deep venous thrombosis As will be seen from the discussion of the pathology a thrombus large enough to cause trouble *cannot* form in a rapidly flowing blood stream A degree of venous stasis sufficient to allow the development of a thrombus and subsequent propagated clot is easily produced in a patient confined to bed, particularly after surgical operation when any movement is painful With the patient lying still in bed the calf muscle pump is inactive there are large pools of blood in the veins of the legs and pelvis and these with the tissue injury occasioned by the surgical procedure (especially in pelvic operations) all combine to slow the venous return to the heart and provide all the factors necessary to initiate the process of venous thrombosis Fortunately this is a factor which can be dealt with In other words early ambulation or early movements whether active or passive, can be offered to our bedridden and static patients

This applies especially to the elderly sufferer

Tissue injury

Any form of tissue injury apart from direct injury to the vessel wall, will tend to cause local clotting by the release of *thrombokinase* Injury to the vessel wall will cause a roughening of the intima and so initiate the whole process of throm bosis It must be remembered that even the slightest trauma may start off the process so that not only should the greatest gentleness be exercised in the per formance of any surgical operation but the patient as a whole should be treated with gentleness while being positioned on the operating table Long-continued pressure on the patient s calf muscles on the operating table is thought to be a potent cause of calf vein thrombosis and should therefore be scrupulously avoided.

Alteration in viscosity of the blood

This factor is seen most frequently in cases of *polycythaemia rubra vera* or severe *dehydration,* when there is little doubt that the increased viscosity of the blood is the main cause of the thrombosis

The association between deep venous thrombosis and *malignant disease* would seem to be more frequent than could be accounted for by mere coincidence and it is possible that some abnormality of the blood may be the link. Certainly any unexplained thrombotic episodes occurring in a patient over forty years of age should raise the suspicion of a hidden carcinoma elsewhere

Thrombotic episodes undoubtedly occur more commonly in certain debilitating diseases such as *typhoid fever* and *pneumonia*, and although alteration of blood viscosity may be a factor here the accompanying disease may be equally to blame

Many other factors have been mentioned from time to time as being associated with thrombosis, but of these only *cardiovascular disease*, *obesity* and *advancing age* can really be seriously considered

Obesity

Pulmonary embolism and thrombophlebitis are far more common in patients suffering from excess weight It has been shown by Snow and Anderson that twice as many embolisms occur after operation in patients who weigh over two hundred pounds Puerperal ilio-femoral thrombosis occurs essentially in fat women, most commonly in primiparae from the age of thirty to forty It is my habit to avoid operating on the varices of overweight patients They must be of normal weight and active in order to avoid an added risk of thrombosis The patient who is not prepared to reduce her weight will as a rule prove to be an unsatisfactory type upon whom to operate A high protein diet, as discussed later, will remove one stone a month from the most greedy sufferer

Debility

Debilitating diseases, especially carcinoma, are a proven factor in the causation of thrombophlebitis and it is interesting to note that Pratt found that one out of every four of the massive pulmonary emboli in his series occurred in patients suffering from carcinoma Unexplained ilio-femoral thrombosis occurring in a man of fifty-five strongly suggests the presence of a carcinoma elsewhere

Age

Thrombophlebitis is far commoner in those over forty years of age Stich (1935) reported that 84 per cent of his patients were in this age group Pratt again found that in a review of 90 cases of massive pulmonary emboli 80 per cent occurred in patients of over forty years of age

Tobacco

Workers in America, such as Duryee, Irving Wright and Pratt, feel that an excessive use of tobacco may precipitate clotting This is a difficult point to prove, but the connexion between tobacco and arterial spasm has been well recognized for years

Familial

Irving Wright (1952) calls our attention to families who have thrombosing tendencies

Pathology

The mechanism of thrombus formation was first described by Aschoff (1924), and Hadfield (1950) has recently re-emphasized the importance of understanding the basic pathology of the condition

The first stage in the formation of a thrombus is a deposition of platelets on any area of roughening or irregularity of the vein lining or intima (Fig 217 *a*) Such roughening could be produced by trauma or inflammation in adjacent tissue, and it is a normal mechanism of repair for the platelets to adhere to this area in an

endeavour to restore the smooth lining of the vein Normally the repair process would go no further as the speed of blood flow would preclude any further cells from becoming stuck to the platelets If however the blood flow in the vessel has been slowed for any reason a small mound of platelets and entangled blood cells rapidly builds up This presents a laminated appearance and is known as the "coralline thrombus" (Fig 217 *b*) Its surface is marked by the "ripple lines of Zahn" which may be likened to the small furrows left on a sandy beach by the receding tide

The deviation of blood flow caused by this "coralline thrombus" gives rise to marked eddying and further clotting immediately on the downstream side of the thrombus and this is likely to continue until the whole vessel is occluded (Fig 217 *c*)

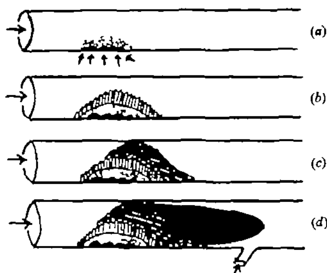


FIG 217 —Diagrammatic representation of the pathology of thrombosis (*after Hadfield*) For description see text.

The final stage is the clotting of the static blood between the thrombus and the entrance of the next main tributary (Fig 217 *d*) This clot—"*consecutive*" or "*propagated*"—lies free in the lumen of the vein and is attached only at its distal end to the original thrombus It is this clot which so easily breaks off and forms the dreaded embolus

If the thrombosis occurs in the calf veins this propagated clot is small in size and tends to be multiple as many short veins within the area of muscle are involved. The emboli which arise from calf vein thrombosis therefore tend to be small and often repeated On the other hand, thrombosis occurring in a major leg vessel may give rise to a very long propagated clot, notably in the ilio-femoral vein A massive and fatal pulmonary embolus may often result from this

This stage of the process is known as "*phlebothrombosis*" and it is essential to realize that it is *clinically silent* This is due to the fact that the original thrombus may be so small that it cannot be detected clinically and although a large section of a major vein may contain clot this causes no venous obstruction as it rapidly retracts and leaves the lumen at least partially patent

If the propagated clot does not break off the process continues The entire thrombus becomes organized and adheres to the vein wall, causing an intense

sterile inflammatory reaction along the length of the vein affected. The lumen of the vein becomes blocked throughout the length of the clot and clinical evidence of venous obstruction, together with the local and systemic signs of the inflammation, rapidly becomes obvious Thus we now have the full clinical picture of *thrombophlebitis*

It is important to appreciate that phlebothrombosis and thrombophlebitis are nothing more than two different stages of the *same pathological process* It is perfectly possible, therefore, for the two stages to be present at the same time in the same patient

The final stage of complete *organization* leaves the vein as a solid fibrous cord through which *recanalization* may or may not occur.

Clinical picture

There are certain general signs and symptoms associated with all cases of thrombophlebitis, but as will be seen later there are many signs peculiar to the exact area of the lesion, these will be given separately under different headings Generally speaking, thrombophlebitis is associated with pain together with tenderness Swelling of a limb may occur and oedema is present in severe cases A general reaction to the condition may express itself by the presence of pyrexia and general malaise The acute stage of thrombophlebitis lasts a variable time before presenting the condition of chronic venous insufficiency, but with treatment a subsidence of acute symptoms may be expected within a week or two. The signs and symptoms of thrombophlebitis may now be studied according to the localization of the disease

Phlebothrombosis

It must be remembered that this stage of the process is *clinically silent* The first indication of its presence is either a pulmonary embolus which comes as a " bolt from the blue ", or the onset 48 hours later of the next stage of thrombophlebitis

Thrombophlebitis of the deep calf veins

In the vast majority of patients suffering from deep vein thrombosis the site of origin is either in the deep veins of the calf or in the popliteal vein itself.

This is the most important condition so far as diagnosis is concerned, since it is this type of thrombophlebitis which, if early and adequate treatment is not instituted, may lead to extensive thrombosis and the serious risk of embolism Any patient who either after an operation or after a pregnancy shows an inexplicable rise in temperature and pulse rate must be examined most carefully in order to exclude thrombophlebitis of the deep veins *It must again be emphasized that pyrexia, however slight, occurring at about the fourth or fifth day after operation must always make one suspect the condition under discussion* Beyond this temperature the patient may only admit to a slight cramp or aching in one of the calves, and this symptom may be quite transient

Constitutional symptoms may be absent, although restlessness is sometimes present Any definite signs such as swelling of the legs or glassiness of the skin or engorgement of the superficial veins are late signs and as a rule they appear when the valuable time for anti-coagulant therapy has passed

Signs and symptoms vary widely according to the extent, site and type of the lesion The following are usually present.

Pain —Wide variations in the amount of pain usually occur It may be severe enough to need opiates or so slight as to be ignored by the patient

Tenderness —This occurs on pressure either in the middle of the calf or in the popliteal space

Fever —A slight temperature is usually present in the earliest stage but even when absent a raised pulse rate should make the examiner suspicious as this is a most constant sign.

Colour changes —In the early stages changes in the colour of the limb are not usual. Blockage of a large vein however in time will cause a dusky cyanosis to appear

Oedema —Again this is not the earliest sign of deep vein thrombosis but in about half of the patients affected oedema is to be expected within the first day or two of the inflammatory process.

Examination —When examining the limb it is essential that the calf muscles should be relaxed by bending the patient s knees Careful palpation should then be done throughout the whole area of the popliteal and tibial veins Any point of tenderness must be noted *Homans s sign* is of value this may be evinced by acute dorsiflexion of the foot which, in the presence of deep vein thrombophlebitis will produce a localized pain in the calf

All house surgeons should be on the look out for this condition of deep vein thrombophlebitis and should be shown the correct method of examining the leg. They must realize that other causes of post operative pain and tenderness in the calf muscles are rare and that all patients with pyrexia must be suspected of thrombophlebitis until the converse can be proved In this way embolism can be made much less common than it now is

Ilio-femoral thrombophlebitis

Ilio-femoral involvement usually follows a more distal thrombophlebitis Gunnar Bauer states that in his own investigations only 3 per cent of cases arose in the veins of the thigh and pelvis The other 97 per cent originated in the deep veins of the calf When established this condition usually gives rise to constitutional symptoms and pyrexia of 102 F is not uncommon A general feeling of malaise is fairly constant Many authors call attention to the diagnostic triad which consists of the following.

(1) Swelling of the limb
(2) Congestion of the skin and engorgement of the superficial veins
(3) Tenderness over the femoral vein in Scarpa s triangle

Although the first two symptoms may disappear after a few days tenderness in Scarpa s triangle may last for a considerable time.

This is the classical picture of the *white leg* or *phlegmasia alba dolens* which is so commonly seen following childbirth In this condition the predominant clinical feature is oedema with a normal or pale skin colour If however the venous obstruction is more extensive and the large collateral veins are involved by the thrombophlebitis marked cyanosis of the limb also occurs particularly in its lower part Necrotic changes may supervene This is the more serious condition

known as "*phlegmasia caerulea dolens*" The basic pathology of the two conditions is the same and the difference is one of the degree of venous obstruction only Fortunately, the latter type is rare

By the time either of these clinical conditions has appeared the dangerous stage of phlebothrombosis in that leg has passed and the risk of pulmonary embolism has receded It is uncommon for embolism to occur in combination with an established "white leg" In the occasional case, however, the condition of phlebothrombosis may be present in the other leg at the same time and this may prove to be the seat of the embolism

The reader is recommended to turn to page 325 regarding the differential diagnosis between oedematous conditions due to lymphatic involvement and those due to venous occlusion Lymphoedema is the only condition which may cause difficulty so far as differential diagnosis is concerned It should be remembered, however, that ilio-femoral thrombophlebitis has an acute onset in contradistinction to that due to lymphoedema Acute *arterial* obstruction presents a pale leg rather than the swollen and cyanotic leg associated with venous occlusion

Complications

Before considering the treatment of thrombophlebitis occurring in various locations in the venous system of the legs it is of interest to tabulate the complications of deep vein thrombophlebitis which may occur

(1) Pulmonary embolism.
(2) The development of secondary varices
(3) A sequela rather than a complication which may be termed chronic venous insufficiency
(4) Muscular atrophy
(5) Post-phlebitic neuritis
(6) Pyaemia
(7) Gangrene

Pulmonary embolism

Amongst the above complications pulmonary embolism is the most important and for this reason the discussion of the treatment of this condition is given elsewhere (*see* p 243)

Secondary varicose veins

Secondary varicose veins are usually found in cases of chronic venous insufficiency and they may be a cause of additional embarrassment to the venous circulation of the leg These secondary varices may appear in the lower abdomen above Poupart's ligament or may affect the main trunks of the saphenous veins Their treatment is discussed elsewhere and considerable judgment and accurate testing of these veins are required before either surgical or sclerosant measures are advised

Chronic venous insufficiency

This is the result of the permanent venous obstruction and valvular incompetence left by the process of organization following thrombophlebitis

Chronic venous insufficiency shows itself by the development of oedema, which is increased by prolonged standing This oedema produces a heavy, aching limb and may be further complicated by the presence of a congested compensatory superficial venous system. Chronic venous insufficiency, if untreated, may give

rise to varicose eczema and ulceration The treatment of this condition by compression bandages such as the two-way stretch bandage is described in the chapter on conservative treatment of varices and in the chapter on bandaging technique Sufferers from chronic venous insufficiency are sometimes neglected by the profession and are not advised regarding adequate supportive measures They are apt to fall into the category of incurable post thrombotic ulcer All that is needed is the correct selection of the proper type of support in order to prevent almost inevitable ulceration The two way stretch bandage used correctly over a length of time will, in very many cases, help considerably in the process of recanalization of obstruction in the deep veins of the leg. All patients with oedematous limbs of many years duration should be told of this possibility They may well be successful if they persevere with this simple treatment

Muscular atrophy

Atrophic changes in the muscles are not only associated with this chronic venous insufficiency which is a late result of acute thrombophlebitis of the deep veins, but may also be seen in any sufferer from severe untreated varices Flabby calf muscles and flat feet are frequently found in these patients From the practical viewpoint those treating varices must have some knowledge in advising their patients regarding the treatment of pes planus and so on

Post-phlebitic neuritis

Post phlebitic neuritis is not as uncommon as might be thought Pain shooting down the superficial sural nerve is sometimes seen in sufferers who give a history of a former attack of superficial phlebitis It is also of interest to note that neuritic pain is sometimes seen in patients who have been submitted to ligation of the external saphenous vein From the practical point of view it is of interest that these patients may be cured by local block anaesthesia with procaine

Pyaemia

Fortunately pyaemia is rare and only complicates those cases of suppurative thrombophlebitis which have not reacted either to penicillin or to other chemotherapy If established it may well prove fatal

Gangrene

Gangrene is fortunately also rare As previously pointed out, Nature most kindly affords a compensatory collateral circulation in cases of ilio-femoral thrombosis Only if this fails does the condition of " phlegmasia caerulea dolens occur Gangrene sometimes occurs in the extreme form of this condition and implies some degree of arterial involvement

TREATMENT OF DEEP VEIN THROMBOPHLEBITIS

In considering the treatment of thrombophlebitis as in all therapy preventive measures must take preference Furthermore the treatment of the acute stage will be found to depend largely upon the early recognition of the disease. A special note should be made of the all important treatment of deep vein thrombosis which when correctly carried out, will prevent many cases of embolism and lessen the number of cases of chronic venous insufficiency associated with post thrombotic ulceration and eczema

There are therefore three stages of treatment to be considered

(1) Prevention of thrombosis

(2) Treatment of established thrombophlebitis

(3) Treatment of sequelae—chronic venous insufficiency Of these stages, quite the most important, and yet the most neglected, is *prevention.*

Preventive measures

Prevention is always better than cure, and there can be little doubt that if greater attention were paid to the following simple measures, post-operative deep venous thrombophlebitis would be very much less common than it is now

Avoidance of trauma

(1) Care in moving the unconscious patient

(2) Pressure on calves to be avoided

(3) Gentle surgical technique

Measures to improve venous return from legs

(1) *Early active* exercises of legs in bed

(2) *Early* deep breathing exercises

(3) *Early ambulation* The patient should get out of bed to *walk* and *not to sit*

(4) If for any reason these measures cannot be satisfactorily carried out the venous return from the legs should be encouraged by *elevating the foot of the bed* 9–12 inches until the patient is well enough to co-operate (Payling Wright (1953) has shown that this simple manoeuvre alone can increase the venous return from the legs fourfold)

(5) Needless to say, the rigid enforcement of Fowler's position, particularly by the use of a " donkey " beneath the thighs, should be condemned

Other measures

The correction of the fluid balance and of blood dyscrasias if these are present, is all important In addition, clearance of focal sepsis should receive careful pre-operative attention

Prophylactic anti-coagulant therapy

Despite the impressive figures given by Gunnar Bauer (1946), it is doubtful if the wholesale prophylactic use of anti-coagulants is a justifiable procedure, and it has not received wide acceptance in this country

Treatment of established thrombophlebitis

It is only fair to state that opinion on this subject is sharply divided The main bone of contention lies in the use of anti-coagulants Some authorities regard their use as essential while others consider them unnecessary and even dangerous Therefore, while the author's preferences will be stated, any conflicting views will be noted so that the reader can make up his own mind on the subject

Treatment of calf-vein thrombosis

Where the condition is localized to the calf veins, the author believes that the best treatment is simple activity of the leg If the patient is in bed the foot of the bed should be raised, a firm bandage applied from toe to knee and *active* ankle and knee exercises enforced (Five minutes every hour, on the hour, is a good rule)

If the condition occurs when the patient is ambulant (this is surprisingly frequent) nothing more than the application of an elastic bandage and the further encouragement of active exercise is required

In the authors opinion there is *no* indication for anti-coagulant therapy in the uncomplicated case

The place of anti-coagulant therapy and proximal venous ligation is considered later in this chapter

Treatment of ilio-femoral thrombophlebitis (white leg ")

Because of the seriousness of this condition and the long term sequelae it is here that the differences of opinion with regard to treatment are most marked

In the *acute phase* of the condition the limb is grossly oedematous and painful and there is probably an added element of vascular spasm

All are agreed, therefore that the only practicable treatment at this time is for the limb to be *rested with the foot of the bed raised* at least 12 inches Some analgesics are usually necessary

Boyd (1958) and Dickson Wright (1958) believe that the acute phase can be materially shortened by the use of *paravertebral sympathetic block* to relieve the associated vascular spasm It would seem to others however that this would increase the amount of blood entering the limb just at the time when the obstruction of the veins is at its height and it could consequently only aggravate the congestion in the limb

Oldham (1958) is strongly in favour of immediate *anti-coagulant therapy* with the object of preventing any further intravascular clotting and preserving the venous return through such collaterals as are patent

In practice, the authors have not been able to prove to their own satisfaction that either of these two measures has been of much benefit except in the most fulminating cases and do not usually employ them

Over the past twelve months one of us (A G D) working with Dr T C Thorne has had the opportunity of treating several cases of acute deep vein thrombosis by epidural block anaesthesia The immediate benefit to the patient and the results are extremely satisfactory In two cases the procedure was repeated 48 hours later and the acute phase of the thrombosis seemed to be thus shortened very considerably Since epidural block anaesthesia is now an almost standard procedure in most hospitals in this country it is felt that the assistance of a skilled anaesthetist in these cases can be of real value

While the limb is being rested in elevation the local application of warm moist heat is soothing and helpful in so far as it causes a relief of venous spasm and helps in improving the collateral venous return through the superficial veins The limb is covered with Nivea cream to protect the skin and towelling is wrung out in hot water and loosely applied to the whole extremity Hot water bottles or an electric blanket are placed around the towelling to provide constant warmth The progress of the limb is now carefully watched Usually the condition begins to improve quite rapidly but occasionally it becomes obvious in the succeeding 12–24 hours that the thrombotic process is spreading rather than resolving These are the cases in which the author uses anti-coagulant therapy (*See* page 244)

As soon as the pain and oedema begin to subside usually within 48 to 72 hours *gentle active exercises* of knee and ankle may be started When the patient has

shown that knee and ankle movements can be performed reasonably easily, it is often of benefit to ask the physiotherapist to start *light massage* to speed the resolution of the oedema

The patient is kept in bed until the oedema has subsided almost completely, by which time full knee, ankle and thigh movements should be possible A firm, carefully applied elastic bandage (T W S) is now applied and the patient is gradually allowed out of bed for walking exercises

It is imperative that the patient is not allowed to get out of bed unless the limb is properly bandaged She must further realize that the venous circulation in that leg may be permanently damaged, and that prolonged elastic support is essential to avoid the sequelae of chronic oedema, induration and ulceration

Irving Wright (1952) has done us a great service in calling attention to the avoidance of deep breathing and strain during the acute stage of thrombophlebitis He points out that deep breathing introduces negative phases of pressure which tend to free loosely attached thrombi He points out how frequently patients are asked to breathe deeply when their chests are being examined for suspected emboli Such procedure is dangerous and is not necessary, since the diagnosis is usually made quite certain by the symptoms The place of proximal venous ligation is discussed under the heading of pulmonary embolism

Treatment of chronic venous insufficiency

Before the patient is allowed to leave his bed, to which he has been confined during the acute pyrexial stage of the disease, the signs of chronic venous insufficiency, such as oedema and congestion of the superficial venous system, must receive treatment Correct supportive treatment is essential from the very commencement if ulceration and eczema are to be avoided in the future This matter is discussed in the chapter on bandaging technique and mainly consists of the use either of sticky or dry elastic bandages. In particular the two-way-stretch bandage is of service, and its use in the early stages will not only help to prevent the formation of oedema but from its massaging action during ambulation may have a beneficial effect on the recanalization of the deep veins In fact, the patient should not be allowed to leave his bed without the proper application of an elastic bandage At this time he could use the special chair which is recommended by the author and illustrated on page 186 Later on, physiotherapy and massage may be given with advantage The patient *must* realize that supportive therapy should be continued for *at least six months* and possibly for the rest of his life

Previous deep vein thrombophlebitis and pregnancy

Patients frequently ask whether it is safe for them to undergo a further pregnancy having previously suffered from a "white leg" Every patient has to be considered as a separate problem If the deep veins have recovered sufficiently and oedema and ulceration are absent, a further pregnancy is not contra-indicated, but careful supervision and adequate bandage support is essential throughout the pregnancy

Again, one is sometimes asked whether a therapeutic abortion is advisable owing to the severity of the varices and to the complications in either the deep or superficial venous systems. Again, there is no hard and fast rule, but the majority

of patients can be steered through subsequent pregnancies provided adequate precautions are taken However oedematous ulcerated limbs may well be made so much worse by a further pregnancy that the mother may find herself crippled in her future life Under these conditions the varices may well be considered to be an additional factor whilst taking into consideration the general state of the mother in advising that the pregnancy should be terminated When consulted in this matter however it must be realized that varices and their complications improve considerably after parturition There is always the case however in which after weighing up the pros and cons we are obliged to recommend that further pregnancies would be so deleterious to the patient s health that it would be unwise to allow her to continue with her pregnancy

Summary

(1) A clear understanding of the pathology of thrombosis is essential if logical treatment is to be given

(2) Prevention is better than cure To permit venous stasis is to permit thrombosis The factors conducive to thrombosis are assessed

(3) Views regarding the use and possible abuse of anti-coagulant drugs are discussed

(4) Long term treatment is just as important as the immediate treatment Only in this way will the results of the indurated leg be avoided

PULMONARY EMBOLISM

Incidence

Many studies of the incidence of fatal pulmonary embolism in surgical cases over recent years have been made From these it is possible to conclude that one patient in every 750–1000 submitted to surgery will die from embolism From the statistics of earlier years (1920–30) it would seem that mortality has been halved as the average incidence for that period was approximately one in every 500 cases (Henderson 1927 Matas 1932 and Barker Hygaard Walters and Priestley 1940)

The occurrence of non fatal pulmonary embolism is less well recorded but Murley (1950) and Jorpes (1950) agree that it is *at least five* times as common as the fatal variety

It is worth noting that pulmonary embolism occurs just as frequently in medical as in surgical cases and that *varicose vein surgery is followed by no higher incidence than any other operation*

Pathology

The emboli which become impacted in the pulmonary circulation originate from the propagated clot either in the large pelvic veins (ilio-femoral) or the smaller veins within the calf muscles

In the former instance the embolus is massive and usually causes sudden death by occlusion of the main pulmonary artery In the latter it is small (and often repeated) and gives rise to small patches of infarction in the lung tissue, with a typical clinical picture

The *massive embolus* arises from a large propagated clot in the ilio-femoral vein Any sudden increase in the flow of venous blood after a prolonged period

of stasis, such as may be caused by the patient's first attempt to get out of bed or straining at stool, is sufficient to dislodge this clot and force it into the circulation It then passes *en masse* via the heart into the main pulmonary artery, where it becomes impacted, causing sudden massive occlusion of the blood flow through the lung and immediate death from asphyxia (Allen, Barker and Hines, 1955)

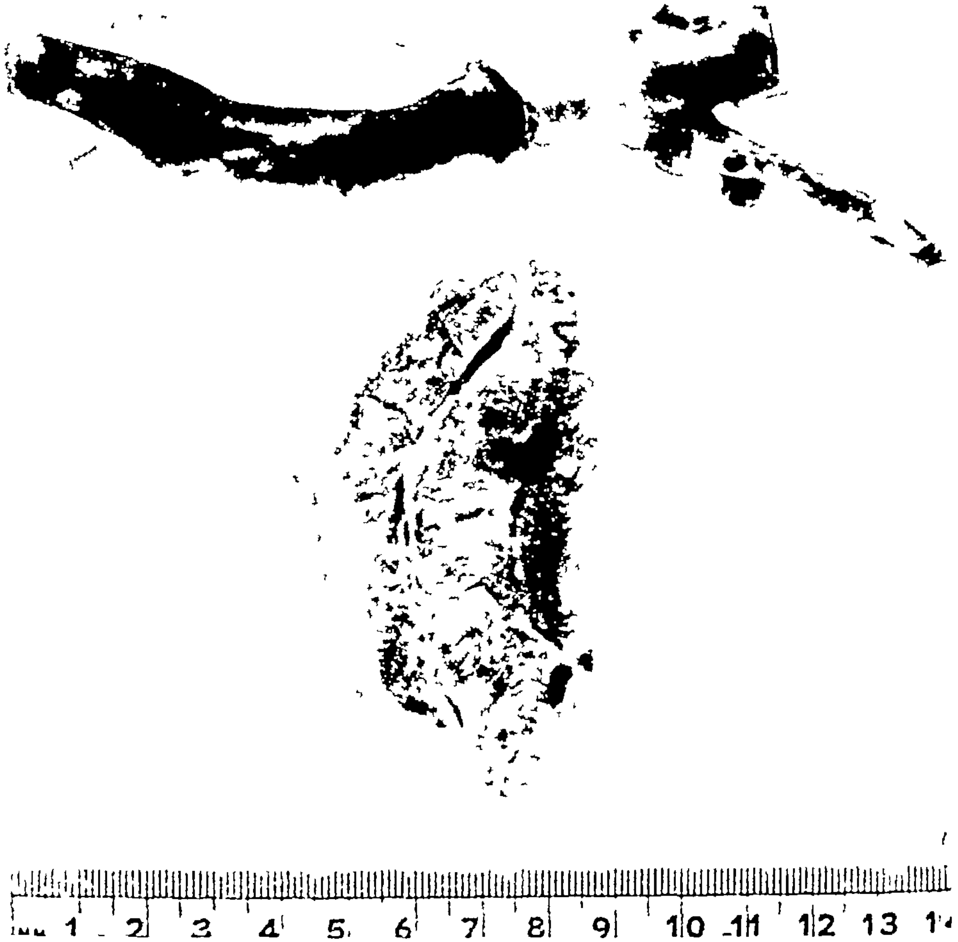


FIG 218 —An organized clot in the femoral vein together with thrombosis of the deep veins of the calf muscles It is in these deep veins that the dangerous thrombotic condition usually develops, and, as pointed out in the text, the *early* recognition of this process is essential in order to avoid pulmonary embolism, which occurred in this particular case

In some 20–30 per cent of cases, the embolus is not large enough to obstruct the pulmonary artery completely, but the fatal issue is not long delayed and is then due to acute cor pulmonale

The *small embolus* originates in the smaller leg veins, most commonly the muscular branches in the calf muscles, or as a fragment of the propagated clot above an area of *thrombophlebitis* in one of the longer leg veins The size of the embolus is thus limited and may be no larger than a grain of rice Because the lesion is inflammatory in nature, many small veins in the locality are involved and

potential emboli form in each This explains why the smaller emboli tend to be multiple or repeated As in the case of the massive embolus its passage into the circulation is occasioned by sudden movement and increased venous flow



FIG. 219 —Pulmonary embolism. An organized clot is to be seen in the pulmonary artery this embolism is the sequel to the thrombotic process shown in Fig 218

The impaction of a small embolus in the pulmonary arterial tree results in the formation of a small wedge-shaped pulmonary infarct near the periphery of the lung and most commonly in the lower lobe

Small emboli rarely cause death immediately but if repeated they may gradually occlude the pulmonary circulation sufficiently to cause a fatal degree of subacute

cor pulmonale This has been shown experimentally by Harrison (1948) According to Allen, Barker and Hines (1955) thrombophlebitis migrans produces fatal pulmonary embolism in about 5 per cent of cases

While it is comparatively uncommon for pulmonary emboli to arise from varicose veins owing to their tortuosity, varying calibre and stagnant blood flow, the possibility should always be borne in mind whenever thrombophlebitis occurs

Clinical picture

The massive pulmonary embolus

The massive pulmonary embolus comes as a " bolt from the blue ". Rarely are there any warning signs or symptoms, and the sudden fatal collapse on the



FIG 220 —Pulmonary emboli Two small branches of the pulmonary artery are blocked by plugs of clotted blood, the surrounding alveoli are filled with granular debris and leucocytes

tenth to fourteenth post-operative day can hardly offer any difficulty as far as diagnosis is concerned Death usually occurs within minutes of the onset, but in a few cases it may be delayed an hour or two

The small embolus

The small embolus, on the other hand, is often preceded by obvious clinical evidence of thrombophlebitis in the leg or calf veins

Any attack of pleurisy in the post-operative period should raise grave suspicion of embolism This pleural pain may be associated with haemoptysis, an apprehensive mental state and a raised pulse rate Pyrexia, if present, is usually only slight The established signs of pulmonary infarction such as a friction rub, moist râles and so on, are not usually present in the early stage and diagnosis must be made on the symptoms Radiography of the chest may confirm the

diagnosis by showing a wedge-shaped shadow in the pulmonary field, together with an elevation of the diaphragm on the affected side and limitation of its movement. As often as not, positive radiological findings are absent in the early stage and reliance cannot be placed on this method of diagnosis The patient suffering from embolism requires rest. Deep breathing during the examination to ascertain the location of the infarct should be avoided Again X ray findings at this stage are purely of academic interest. A diagnosis may be made on symptoms and the quieter the patient is kept the better

Differential diagnosis

Pulmonary embolism with its dramatic onset usually offers but little difficulty in diagnosis

Coronary thrombosis—A sudden attack of coronary thrombosis may in part imitate acute embolism. The pain however is not pleuritic in character and may quite typically shoot down the arms. The presence of substernal pain is more indicative of coronary thrombosis than of pulmonary embolism Cyanosis is not usually present. In cases of doubt the electrocardiogram will show a different picture from that produced by pulmonary embolism

Pneumonia—Pneumonia is unlikely to confuse a good clinician, since a high temperature in combination with a cough and signs of infection should make him suspect the condition These symptoms are usually accompanied by definite signs in the chest which are absent in the early stages of embolism

Sequelae of pulmonary embolism

As a rule, in those patients who have lived through the primary attack of embolism the condition will clear up in a week or two and leave no complications. Some patients who have sustained extensive infarction however may be left with pleural adhesions and a localized pulmonary fibrosis the antecedent condition being one of pulmonary effusion Pulmonary necrosis and abscess are fortunately rare sequelae to a pulmonary embolism but cases sometimes occur

Treatment

The methods of prevention applied to thrombophlebitis apply equally to the methods for the prevention of embolism (*see* page 236) The introduction of early ambulatory measures following operation and childbirth is of particular importance in prophylaxis In addition it should always be remembered that when called upon to operate on a patient who has been in bed for some considerable time it is wise, when possible, to get him up and make him walk a little before subjecting him to surgery It cannot be repeated too often that the early clinical signs of thrombophlebitis must be looked for and recognized. In all patients showing change in pulse or temperature in the post-operative period or the presence of a slight transient cramp in the calf muscles, a grave suspicion of deep vein thrombophlebitis must be awakened. The prophylactic measures already described and the early diagnosis of deep vein thrombophlebitis are essential in the prevention of embolism

In detailing the treatment of established pulmonary embolism these cases will be somewhat arbitrarily divided, for simplicity's sake into two groups This method has already been adopted when considering the signs and symptoms

The small embolus

This acute emergency should be treated by the following measures

(1) An immediate injection of papaverine hydrochloride, grain ½ in conjunction with atropine sulphate, grain $\frac{1}{100}$

(2) The administration of oxygen

(3) Full anti-coagulant therapy as described on page 248

In the early stages all the recognized methods for the relief of shock should be instituted Prolonged rest in bed is not necessary, however, and patients should not be so confined for more than a few days after the acute symptoms have subsided For additional safety anti-coagulant therapy should be continued for at least a week after the patient is up and about

The massive and fatal embolus

Pulmonary embolectomy has been condemned by most of the authorities, including Allen, Barker and Hines (1947), who state that " in those patients who survive long enough for the operation to be begun the risk of death from the operation is little less than the risk of death from the embolism if the operation is not done " This appears to be the accepted opinion at this time

Summary

The prevention of embolism is of the utmost importance and every care should be taken to note the earliest signs and symptoms of the antecedent thrombophlebitis Rapidly instituted anti-coagulant therapy will prevent the formation of further emboli and additions to the one already present

Those who survive a primary attack of embolism and who receive no anti-coagulant treatment run a *one in three chance of further embolism and a one in five chance of death* Correct and immediate treatment must be given in order to save their lives However, those of us who have been faced with the tragedy of fatal embolism may find some comfort from Pulvertaft (1947) who after analysing a large number of fatal cases remarked that " the majority of the cases were men and women whose hour of death was not long to be postponed from the nature of their condition, and to whom death came, if suddenly, as a merciful euthanasia "

ANTI-COAGULANT THERAPY

The anti-coagulant drugs, when given in adequate dosage, can be used prophylactically to prevent a venous thrombosis, and therapeutically to prevent an extension of a thrombosis which has already developed It is proposed to discuss their use in the prevention and treatment of thrombophlebitis and pulmonary embolism only, although many other conditions such as coronary thrombosis may be benefited by this treatment

The anti-coagulants in common use fall into two main groups In the first, heparin stands alone The second group comprises a number of synthetic substances which all act by *reducing the production of prothrombin* by the liver

Used correctly, these drugs are most valuable weapons in the fight against pulmonary embolism and thrombophlebitis but injudicious use can lead to the direst consequences

Some recent work by Moser in the United States on fibrinolysin suggests that this substance may be of some value in dissolving intravascular clots This approach, however has yet to be developed

Indications for anti-coagulant therapy

The cardinal indication for anti-coagulant therapy is the occurrence of *pulmonary embolism* On its place in the treatment of deep vein *thrombophlebitis* as has already been mentioned there is still disagreement. There may be a place for it in the *prophylaxis* of future episodes of thrombosis in patients with known thrombotic tendencies and the physicians have recently been gaining much experience in its use in the fields of *coronary* and *cerebral thrombosis*

In the authors opinion there is no place whatsoever for the blunderbuss routine post-operative administration of anti-coagulants

Contra indications to anti-coagulant therapy

Anti-coagulant drugs should *never* be administered to any patient with an *open wound* or any condition from which haemorrhage might possibly occur This includes *peptic ulceration haemorrhagic diathesis* or *advanced pregnancy*

With the exception of heparin, no anti-coagulants should ever be used in the presence of *liver damage*

In cases of doubt, where anti-coagulant therapy is otherwise deemed essential heparin is the drug of choice, because of its short lived effect, lack of liver toxicity and the availability of an immediate antidote

Heparin

Heparin is normally present in the body particularly in the large capillary beds such as the lung and liver where presumably its function is to prevent intravascular clotting Commercially the chemical is isolated from mammalian lung tissue and standardized in international units The original Toronto unit is now no longer used

Administration and dosage

Heparin can only be satisfactorily administered by *intravenous* injection Intramuscular injection is painful and likely to cause large haematomata Since the drug is destroyed rapidly injections must be repeated every 4–6 hours if an effective blood level is to be maintained This can be performed most simply by the use of an indwelling intravenous needle of the Gordh type which can be left in the vein for 24–48 hours without causing undue discomfort Heparin treatment has now become so standardized that no form of laboratory control is considered necessary (A therapeutic level is obtained when the coagulation time of the blood is raised to between 20 and 30 minutes)

The average dosage required is 5 000 international units 4-hourly but the authors are inclined to regard this as a minimum and are prepared to give even double this dosage in certain cases

Protamine sulphate is the specific antidote to heparin

Should haemorrhage occur while a patient is on heparin the drug should be stopped and an *immediate intravenous injection* of protamine sulphate given (1 millilitre of 1 per cent solution for every 1 000 international units of heparin given in the last injection) The effect is instantaneous and it is rarely necessary to repeat the dose

Rothnie and Kinmonth have recently found that the heparin which is added to perfused blood during open heart surgery is not fully neutralized by the standard protamine sulphate and they have had occasion to use a new compound

" polybrene ", which appears to be consistently effective in neutralizing the anti-coagulant properties of heparin. Although this drug is still in the experimental stage, it would seem likely that it will become a more satisfactory antidote for use in cases of haemorrhage due to heparin therapy.

The anti-prothrombin group

All the drugs which fall into this group do so because their basic function is to reduce the prothrombin output of the liver, and thus indirectly increase the coagulation time of the blood. The fact that they are able to prevent the liver from performing one of its most vital functions means that they are powerful liver poisons This must always be borne in mind whenever their use is contemplated

The fascinating story of the discovery of Dicoumarol in 1921 by Schofield in his studies on sweet clover disease in cattle is by now familiar to all All the more modern anti-coagulant drugs stem from this discovery Both Tromexan and Sinthrome (Geigy) are derivatives of the coumarin group and are safer than Dicoumarol in use because of their more rapid absorption and detoxication in the body Dindevan (Phenylindanedione—Evans) is not a coumarin derivative, but its mode of action is precisely the same

Administration and dosage

All the drugs in this group are administered *orally* Because of this, and because of their indirect mode of action, the full therapeutic effect does not appear until 36–48 hours after the initial dose If an immediate effect is required therefore, it is necessary to give heparin for the first forty-eight hours until the oral anti-coagulant can reach a therapeutic level (A recommended scheme of anti-coagulant treatment is given later in this chapter) *Oral anti-coagulant therapy must be controlled throughout by frequent laboratory estimation of the prothrombin content of the blood* In practice it is advisable that this should be done daily for the first week, and then on alternate days The absorption, and therefore the effect, of these drugs is so variable that such frequent control is essential The method most widely employed is Quick's one-stage estimation of prothrombin time (*see* page 249 for details)

It is now generally agreed that the full therapeutic effect of this group of drugs is not reached until the *prothrombin content of the blood is reduced to* 20–30 *per cent of normal* This is equivalent to increasing the coagulation time by two to three times As a rough guide, in all cases it is best to start with a large loading dose on the first day, halving this on the second day and then continuing with a slightly lower maintenance dose on the succeeding days The maintenance dose is varied according to the results of the daily prothrombin estimations

The average order of dosage of the various drugs is as follows

TABLE 2

DOSAGE OF ANTI-PROTHROMBIN DRUGS

	Dicoumarol	*Tromexan*	*Sinthrome*	*Dindevan*
1st day	150 mg b d	600 mg b d	12 mg b d	100 mg b d
2nd day	75 mg b d	300 mg b d	8 mg b d	50 mg b d
Maintenance	50–100 mg daily	300–600 mg daily	2–8 mg daily	75–150 mg daily

It must always be remembered that there is very wide variation in the individual response to any of these drugs and the prothrombin estimations should be observed carefully before assessing the dosage for the succeeding 24 hours

The duration of treatment for most venous conditions rarely exceeds three weeks and 7–10 days is usually quite sufficient

Antidote

Should haemorrhage occur while the patient is on oral anti-coagulant therapy the situation is rather more serious than if heparin is being used, as there is no antidote which has an *immediate* effect The drug of choice is vitamin K_1 given intravenously This will cause a definite rise in the prothrombin content of the blood in 6–8 hours and restore normal level in 24–36 hours In cases of *severe* haemorrhage doses of 100–350 milligrams should be given intravenously and in less serious cases 10–50 milligrams should suffice Vitamin K_1 can be given orally but the effect will be further delayed if this route is used

Should the haemorrhage be severe and vitamin K_1 not immediately available, immediate *fresh blood transfusion* is of the greatest assistance Transfusion of stored blood may be necessary to restore blood volume, but is not nearly so effective in stopping the haemorrhage as *fresh* blood Preparations of vitamin K are of doubtful value as antidotes to the oral anti-coagulants

Summary

Comparison of the two types of anti-coagulant drugs can best be shown by the table below

TABLE 3

Comparison of Anti-coagulant Drugs

	Heparin	*Anti-prothrombin Group*
Mode of action	Direct Prevents normal clotting action of blood	Indirect Acts as liver poison reducing prothrombin production
Method of administration	Intravenous injection only	Oral
Speed of action	Immediate	36–48 hours
Duration	4–6 hours	12–24 hours
Method of control	Not required	Daily prothrombin estimation essential
Antidote	Intravenous protamine sulphate (mg. for mg.) Effect instantaneous	Vitamin K_1 Fresh blood transfusion Effect delayed 6–8 hours

Suggested routine anti-coagulant therapy

In practice, the authors have found that it is most satisfactory to apply a single scheme of treatment for all patients requiring anti-coagulant therapy. The basis of the treatment is to start oral anti-coagulants immediately, and cover the initial period of 48 hours before their effect is shown with heparin By this means, immediate prolongation of coagulation time is obtained and can be continued as long as necessary Because the authors have had more practical experience with Dindevan they naturally tend to prefer it, but should the reader wish to use any of the other oral anti-coagulants, the comparable dosage may be obtained from Table 2 (page 246)

Precautions

(1) Check that no contra-indications exist (liver damage, actual or potential bleeding focus, haemorrhagic diathesis)

(2) Take blood for check prothrombin estimation

(3) *Watch for haemorrhage throughout treatment*

(4) Make sure that *Antidotes* (prothrombin sulphate 1 per cent solution, and vitamin K_1) are available

Treatment

First day

(1) Inject *heparin* 15,000 I U intravenously give *Dindevan* (phenylindanedione) 100 milligrams orally

(2) Four hours later Inject *heparin* 7,500 I U intravenously

(3) Eight hours later Inject *heparin* 7,500 I U intravenously give *Dindevan* 100 milligrams orally

(4) Repeat *heparin* 7,500 I U intravenously every 4 hours for 48 hours, then discontinue

Second day

(1) Check prothrombin estimation

(2) Continue *heparin* 4-hourly

(3) Give *Dindevan* 50 milligrams orally b d

Third and succeeding days

(1) Discontinue heparin

(2) Check prothrombin estimation *daily*

(3) Give *Dindevan* 25–75 milligrams orally b d (Dosage according to prothrombin level)

At end of treatment

Discontinue *Dindevan* The prothrombin content of blood will return to normal in 24–48 hours

In the event of haemorrhage

(1) *Stop all anti coagulant drugs immediately*

(2) *Inject vitamin K_1 intravenously* (10–350 milligrams according to severity of haemorrhage)

(3) If haemorrhage occurs in the first 48 hours (during heparin therapy) *inject protamine sulphate intravenously* 5 millilitres of 1 per cent solution Repeat 2 5 millilitres in 2 hours if necessary

(4) *Apply local haemostasis if practicable*

(5) *Start blood transfusion if necessary* Obtain *fresh* blood whenever possible

TESTS USED FOR THE CONTROL OF ANTI-COAGULANT THERAPY

Measurement of coagulation time (Lee and White s modification of Howell s method)

1 millilitre of venous blood is collected in a perfectly *dry* syringe and placed in a clean 75 × 8 millimetre tube The tube must be kept in a waterbath at 37 C throughout the test A rubber cork is inserted and at every half minute the tube is inverted until the blood has formed a firm clot The time is then noted The normal time by this method is 4–10 minutes It is advisable to perform a control with normal blood at the same time under the same conditions

Measurement of prothrombin time (Quick s one stage method)

Solutions required

(a) Thromboplastin extract
(b) Sodium citrate solution (3 8 per cent)
(c) Calcium chloride solution (0·025 molar)

4 5 millilitres of venous blood are collected and *immediately mixed* with 0 5 millilitre of 3 8 per cent sodium citrate solution Mixing must be gentle but thorough The sample is then centrifuged (1 500 r p m for 5–10 minutes)

0·1 millilitre of the plasma is then placed in a 75 × 8 millimetre tube in a waterbath at 37°C and 0 1 millilitre of thromboplastin extract added After a delay of one minute 0·1 millilitre of warmed calcium chloride solution is blown into the tube and the contents quickly mixed A stop-watch is started and the tube carefully watched A fibrin clot appearing quite suddenly marks the end point It is advisable to repeat the test once or twice to obtain an accurate reading

A normal control plasma must be tested in the same way at the same time (normal range 10–14 seconds)

The result is best recorded as a *prothrombin index* which is estimated as follows

$$\frac{\text{Prothrombin time of control plasma}}{\text{Prothrombin time of patient s plasma}} \times 100 = \text{P I}$$

Alternatively the result may be recorded as a simple *prothrombin time* (the control time must always be given for comparison) or as a percentage of *normal prothrombin activity* (based on the results of previously constructed dilution curves made by diluting normal plasma with saline using the *same* batch of thromboplastin extract)

BIBLIOGRAPHY AND REFERENCES

(The following bibliography and references include those for Chapter 13)

Abrahams, D G (1950) "Intramuscular Heparin" *Brit med J*, **2**, 1418

Baillie, M (1793) "Disease in Blood Vessels" *Trans Soc Improv med chir Knowledge*, **1**, 119

de Bakey, M, and Ochsner, A (1939) "Thrombophlebitis and Phlebothrombosis" *Sth Surg*, **8**, 269

Bancroft, F W, Stanley Brown, Margaret, and Quick, A J (1935) "Post-Operative Thrombosis and Embolism" *Amer J Surg*, **28**, 648

Barber, H (1932) "A Case of Thrombophlebitis Migrans" *Brit med J*, **1**, 281

Barker, N W (1935) "Recurrent Idiopathic Thrombophlebitis" *Med Clin N Amer*, **19**, 535

— (1936) "Thrombophlebitis" *Proc Mayo Clin*, **11**, 513

— (1936) "Primary Idiopathic Thrombophlebitis" *Arch intern Med*, **58**, 147

— (1944) "Use of Dicoumarol in Surgery" *Minn med*, **27**, 102

— and Randall, L M (1938) "Postpartum Thrombophlebitis" *Med Clin N Amer*, **22**, 1205

Barnes, A R (1937) "Pulmonary Embolism" *J Amer med Ass*, **109**, 1347

Bauer, G (1947) "Considérations sur L'Evolution, Le Diagnostic et le Traitement des Thromboses Veineuses et des Embolies Pulmonaires" *Lyon Chir*, **42**, 656

Belt, T H (1934) "Thrombosis and Pulmonary Embolism" *Amer J Path*, **10**, 129

Birnberg, V J, and Hansen, A E (1942) "Thrombophlebitis Migrans" *J Pediat*, **21**, 775

Bjerkelund, Chr J (1953) "The Method of Administering Dicoumarol" *Lancet*, **1**, 260

Boyd, A M (1953) Personal Communication

Briggs, J B (1905) "Recurring Phlebitis of Obscure Origin" *Bull Johns Hopk Hosp*, **16**, 228

Brown, G E (1927) "Post-Operative Phlebitis" *Arch Surg, Chicago*, **16**, 245

— Allen, E V, and Mahorner, H R (1928) *Thrombo-Angiitis Obliterans* Philadelphia, Saunders

Buerger, L (1909) "The Veins in Thrombo-Angiitis Obliterans" *J Amer med Ass*, **52**, 1319

— (1914) "Is Thrombo-Angiitis an Infectious Disease?" *Surg Gynec Obstet*, **19**, 582

— (1924 *The Circulatory Disturbances of the Extremities* Philadelphia and London, Saunders

— (1929) "Thrombo-Angiitis Obliterans" *Arch Path*, **7**, 381

Campbell, M, and Morgan, O G (1930) "Unusual Case of Multiple Thrombosis" *Guy's Hosp Rep*, **80**, 34

Chargaff, E (1938) "Chemistry of Blood Coagulation (VII)" *J Biol Chem*, **125**, 671

— and Olson, K B (1937) "Chemistry of Blood" *J Biol Chem*, **122**, 153

Cockett, F B (1953) "The Practical Uses of Venography" *Brit J Radiol*, **26**, 339

Collier, W T (1931) "Thrombo-Phlebitis Migrans" *Lancet*, **2**, 1408

Coombs, C F (1930) "Observations on the Aetiological Correspondence between Anginal Pain and Cardiac Infection" *Quart J Med*, **23**, 233

Crafoord, C, and Jorpes J E (1941) "Heparin as a Prophylactic Against Thrombosis" *J Amer med Ass*, **116**, 2831

Dawson, P (1955) "Effect of Intravenous Vitamin K on the Action of Phenindione" *Brit J med*, **1**, 412

Discussion (1946) On Thrombosis *Proc R Soc Med*, **40**, 193

Douglas, A S, and Brown, A (1952) "Effect of Vitamin K Preparations on Hypoprothrombinaemia induced by Dicoumarol and Tromexan" *Brit med J*, **1**, 412

Duff, I F, Linman, J W, and Birch, R (1951) "The Administration of Heparin" *Surg. Gynec Obstet*, **93** 343

Duryee, A Wilbur (1953) Personal Communication

Eagle, H (1937) "Recent Advances in the Blood Coagulation Problem" *Medicine*, **16**, 95.

Ellison, J B (1931) "Thrombosis Migrans Complicating Scarlet Fever" *Brit J Child Dis*, **28**, 207

Evans, Geoffrey (1951) *Medical Treatment* London, Butterworth

Evans, J A, and Boller, R J (1946) "The Subcutaneous Use of Heparin in Anticoagulant Therapy" *J Amer med Ass*, **131**, 879

Flood, F P, Redish, M H, Bociek, S J, and Shapiro, S (1943) "Thrombophlebitis Disseminata" *N Y St J Med*, **43**, 1121

Foote R Rowden (1953) Letter *Lancet*, **1**, 1002

Greig, G W V (1949) "Post-Operative Thrombosis." *Brit Med. J* 2, 845

Harkavy J (1924) "Phlebitis and Thrombophlebitis Migrans." *Med J Rec* 120 64

Hartfall S J and Armitage G (1932) "Thrombophlebitis Migrans." *Guy's Hosp Rep* 82, 424

Hayem, G (1889) *Du sang et de ses altérations anatomiques* Paris Masson.

Hedenius, P., and Willander O (1936) "The Influence of Intravenous Injection of Heparin in Man on the Time of Coagulation." *Acta med. scand* 88, 443

Herrick W W (1911) "Phlebitis Migrans." *Amer J med Sci* 142, 874

Homans, J (1928) "Thrombophlebitis of Lower Extremities. *Ann Surg* 87 641

— (1946) "The Late Results of Femoral Thrombophlebitis and their Treatment." *New Engl J Med.*, 235 249

Hunter J (1793) "Inflammation of the Internal Coats of Veins. *Trans Soc Improv med chir Knowledge* 1 18

Illingworth, D G (1951) Tromexan and Dicoumarol" *Brit med. J* 1 646

Janes, R M (1951) "A Surgical View of Thrombosis and the Antithrombotics. *Canad. med Ass J.*, 64 319

Jorpes, J E. (1947) *Heparin in the Treatment of Thrombosis* 2nd ed. London Oxford University Press.

— and Bergstrom, S Quoted by Mason (1939)

— Edman, P and Thaning, T (1939) Neutralisation of Action of Heparin by Protamine." *Lancet* 2, 975

— (1953) "Heparin and Thrombosis." *Practitioner* 170 77

Kletz, N (1932) "Thrombo-Phlebitis Migrans." *Lancet* 2, 938

Krumbhaar E. B., and Ehrich, W E (1942) "Frequent Obstructive Anomaly of Mouth of Left Common Iliac Vein" *Tr Amer Physicians*, 57 196

Laennec R. T H (1819). *De l'auscultation médiate* Paris Brosson and Chaudé.

Lehmann, J (1943) "Thrombosis." *Lancet* 1 611

Lempert H (1948) "Dicoumarol" *Brit med J* 1 125

Leriche, R. and Kunlin, J (1934) "Traitement Immédiat des Phlébites Post-Opératoires." *Pr méd* 2, 1481

Loewe, L., and Hirsch, E (1947) "Heparin in the Treatment of Thromboembolic Disease" *J Amer med Ass* 133 1263

Low G C. and Cook A B (1931) "Thrombo-Phlebitis Migrans." *Lancet* 1 584

McDonagh, J E. R. (1927) "Phlebitis and Thrombophlebitis." *Lancet* 1 845

McLachlin, J and Paterson, J C (1951) Some Basic Observations on Venous Thrombosis and Pulmonary Embolism" *Surg Gynec Obstet* 93 1

McLean, J (1916) "The Thromboplastic Action of Cephalin. *Amer J Physiol.*, 41 250

Marsh, F (1947) "Dicoumarol." *Brit med J* 2, 748

Mason, M F (1939) "Heparin" *Surgery* 5 451

Merz, W R., and Aufdermaur A. (1952) "Nebennierenapoplexie bie Heparinverabreichung." *Schweiz med. Wschr.*, 82, 590

Miller J A. W and Drucquer J K (1948) A Case of Dicoumarol Poisoning." *Brit med J* 2, 904

Murray D W G., and Best, C H. (1938) "Heparin and Thrombosis. *J Amer med Ass.*, 110 118

Murray G and Janes, J M (1940) Prevention of Acute Failure of Circulation following Injuries to Large Arteries." *Brit med. J.*, 2, 6.

Ochsner A. (1946) "Venous Thrombosis. *J Amer med Ass.*, 132, 827

Oldham, J B (1953) "Aetiology of Vascular Disease" *Brit med J.*, 2, 628

— (1958) Personal Communication.

Owen, A W (1928) "Thrombo-Phlebitis Migrans." *Brit med J* 1 690

Parkin, T W Hall, B. E. and Watkins, C H (1948) "Experience with Anti-Heparin Compounds in Essential Thrombocytopenia Thrombophlebitis." *Proc Mayo Clin.*, 23 14

Parsons, W H. (1945) "Dicoumarol Therapy in Post-Operative Thrombophlebitis. *Surg Gynec Obstet* 81 79

Pivawer M J (1947) "Dicoumarol." *Brit med J* 2, 928

Pratt, Gerald H (1949) *Surgical Management of Vascular Diseases* London Kimpton

Priestley J T., Essex, H E. and Barker N W (1941) "The Use of Heparin in the Prevention and Treatment of Post-Operative Thrombosis and Embolism" *Proc Mayo Clin* 17 60

Pulvertaft, R J V (1947) "Post-Operative Pulmonary Embolism" *Ann R Coll Surg Engl* 1, 181
Quick, A J (1937) "The Coagulation Defect in Sweet Clover Disease" *Amer J Physiol*, 118, 260
— (1951) "Modern Concepts of Venous Thrombosis" *Practitioner*, 166, 213
Reed, C I (1925) "Intravascular Use of Heparin" *Amer J Physiol*, 74, 79.
Roderick, L M (1929) "Intravascular Use of Heparin" *J Amer vet med Ass*, 74, 314
Ryle, J A (1930) "Thrombo-Phlebitis Migrans" *Lancet*, 2, 731
Schmitz, A, and Fischer, A Quoted by Mason (1939)
Schofield, F W (1924) "Pathology of Sweet Clover Disease in Cattle" *J Amer vet med Ass* 64, 553
Stich (1935) "Annual Session of the German Surgical Society" *J Amer med Ass*, 105, 525
Sulger (1932) Quoted by Matas, R "Post-Operative Thrombosis and Pulmonary Embolism Before and After Lister" Donald C Balfour Lecture in Surgery, *Univ Toronto Med J*, 10, 1
Swirsky, M Y, and Cassano, C (1943) "Thrombophlebitis Migrans" *J Lab clin Med* 28, 1812
de Takats, G (1932) "Resting Infection in Varicose Veins" *Amer J med Sci*, 184, 57
Toohey, M (1952) "Antagonism of Anticoagulants Dicoumarol, Tromexan and Phenylindandione by Vitamin K" *Brit med J*, 2, 687
Welch, C E, and Faxon, H H (1941) "Thrombophlebitis and Pulmonary Embolism" *J Amer med Ass*, 117, 1502
Whitby, and Britton (1957) *Disorders of the Blood*, 8th ed London, Churchill
Wood, P H (1948) "Therapeutic Application of Anti-Coagulants" *Tr Med Soc Lond*, 66, 80
Wright, Irving S (1952) *Vascular Diseases in Clinical Practice*, 2nd ed Chicago, The Year Book Publishers Inc

NEW REFERENCES

Allen, E V, Barker, N W, and Hines, E A (1955) *Peripheral Vascular Diseases*, 2nd ed Philadelphia Saunders
Aschoff, L (1924) *Lectures in Pathology* New York, Hoeber
Barker, N W, Hygaard, K K, Walters, W, and Priestley, J T. (1940) *Proc Mayo Clin*, 15, 769
Boyd, A M (1958) Personal Communication
Hadfield, G (1950) *Ann R Coll Surg Engl*, 6, 219
Henderson, E F (1927) *Arch Surg, Chicago*, 15, 231
Jorpes, J E (1950) *Acta chir scand, Suppl*, 149
Matou, R (1932) *Univ Toronto med Bull*, 10, 1
Moser, K M (1958) *J Amer med Ass*, 167, 1695
Murley, R S (1950) *Ann R Coll Surg Engl*, 6, 283
Oldham, J B (1958) Personal Communication
Rothnie, N G, and Kinmonth, J B (1960) *Brit med J*, 1, 73
Schofield, F W (1924) *J Amer vet med Ass*, 64, 553
Thorne, T C (1960) Personal Communication
Wright, A Dickson (1958) Personal Communication

CHAPTER 15

VENOUS ULCERS—THEIR CAUSE AND DIAGNOSIS

We have already discussed the varicose ulcer We now turn to the far more common and far more troublesome venous ulcer

In the historical chapter we called attention to the debt we owe to Gay who pointed out nearly a hundred years ago that ulcers were not directly due to varices but that the cause lay in other conditions of the venous system of which the presence of varices was but an added complication Little was done to separate the venous from the varicose ulcer although Homans (*see* page 33) some fifty years later re-emphasized the importance of deep vein thrombosis as a common antecedent of ulceration During the past twenty years venography and the study of venous pressures under different conditions have done much to clarify the pathology of venous insufficiency in the lower limb Cockett has helped the subject by his correlation of all the facts and by his careful anatomical studies His original thesis (Cockett and Elgin Jones 1953) should be studied by all those interested in the theories of ulcer causation

I propose to summarize the factors in the causation of venous stasis and resulting ulceration. Although I make the pathological side brief I feel that it is now generally accepted, and it is only necessary to understand the salient features so that we may better understand the practical treatment which I hope to discuss in detail It is interesting to note that most of the research work on the causation of the venous ulcer has been done since the last edition of this manual Throughout the world by means of venography and venous pressure tests we at last are given a clear picture *why* the venous ulcer occurs It is not possible to give credit to all the various workers on the subject, but I do feel that Hojensgard and Stürup (1952) and Cockett (1956) amongst a legion of other brilliant workers have helped to clarify the physiopathology

Before discussing the causation of the venous ulcer it is as well to have the following differentiation in mind

The *varicose ulcer is caused by incompetent superficial varices often in conjunction with a few incompetent communicating veins*

The *venous ulcer* is essentially the result of a *previous deep vein thrombosis* which has caused damage both to the *deep and communicating veins Superficial varices may or may not be present*

We have already discussed and shown examples of the varicose ulcer in Chapter 12

The clinical features of the venous ulcer are very different from those of the varicose ulcer and in practice we soon learn to recognize the limb which is the seat of deep venous incompetence Compare Fig 214 with the Frontispiece Note the swollen, indurated and cyanosed condition of the latter

The *first sign of chronic venous insufficiency* in the vast majority of cases is *oedema* The oedema is usually the subcutaneous type and does not involve the muscles or deeper tissues to any great extent The oedematous fluid gravitates to

the lower part of the leg Note in Fig 221 the fact that the foot does not become swollen if it is supported by a boot or shoe This should show us how very important it is to give supportive treatment in this early stage when the oedema is the only sign of venous insufficiency Compressive treatment at this point will prevent the development of the next stage, which consists so frequently of congestion, cyanosis, thickening of the tissues and pigmentation The "*ankle flare*" demonstrated in Fig 234 may well occur at this stage, and it is a warning of subsequent ulceration Even at this period, however, treatment by support and massage will prevent ulceration, and yet the condition is often allowed to progress untreated until eczema, pruritis, subcutaneous fibrosis and brawny induration make the subsequent development of ulceration only a matter of time



Fig 221 —The right leg shows severe varicose vein disease with slight oedema The left leg is the seat of advanced lymphoedema The presence of these two separate conditions in the same patient is of great interest Note how the oedema is controlled around the foot and ankle *This is due to the wearing* of lace-up boots by the patient who is a farmer The right leg will react well to operative treatment and the left leg should be treated by means of a two-way-stretch bandage and massage until sufficiently reduced in size to permit of the application of a firm supportive stocking

At this third stage in the production of an ulcer the condition many authors refer to as "indurated cellulitis" occurs Usually seen around the inner ankle area, this will demonstrate itself as a small brownish-red patch which is tender to the touch It may be warmer than the surrounding tissues With or without the addition of trauma this patch of "indurated cellulitis" will eventually break down into a venous ulcer If the cellulitis has been present for a long time, the skin and underlying tissues may be depressed This is due to a shrinking and retraction of the tissues, and will be an indication to the examiner that the pre-ulcerative state has been present for a long time

As with the varicose ulcer the position favoured by the venous ulcer is the lower two-thirds of the inner or outer third of the lower leg (*see* Fig 222) In the late stages the "champagne bottle" type of leg develops This limb haunts our

clinics and is due to years of neglect of treatment It is probably caused by constriction of the limb by organized fibrous bands These probably interfere with the lymphatic return as well as localize the hypostatic oedema As a result we have this type of distorted limb

The steady progress of symptoms from oedema disappearing on elevation or compression of the limb to the final stage of massive induration and ulceration, makes us realize how easy treatment would be if all patients were treated in the

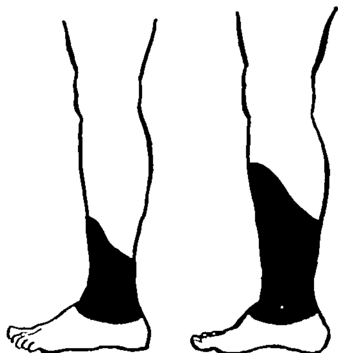


FIG 222.—Diagrams showing the sites for varicose and venous ulceration. Any ulcer which may occur above these areas is not due to a varicose or gravitational causation. As explained in the text this is a point of importance so far as differential diagnosis is concerned.

early stages We have already referred to Boyd s (1950) series in which there was a ten year wait before specialist advice was sought This I am afraid, is not an unusual finding Nor is it unusual to find that after the attack of acute thrombophlebitis the patient resumes her normal life without leg support or massage A crêpe bandage and keep your leg up when possible was the standard advice given to a large series I interrogated in the past

Let us remember that the best time to treat a venous ulcer is before it ever happens The stages in its appearance may be summed up as follows

(1) The episode of acute deep vein thrombosis

(2) Oedema present which disappears on resting.

(3) Oedema present even when the leg is elevated skin changes

(4) Brawny induration with induration cellulitis "

(5) Ulceration champagne bottle limb

Now to return to the cause or physiopathology of ulceration

Primary causes

Past deep vein thrombosis

There is no doubt that the vast majority of venous ulcers have a history of past deep vein thrombosis Statistics from various clinics vary considerably Gunnar Bauer (1951) states that in a series he found this history to be present in 80 per cent of cases There are others such as Dodd (1956) who put the figure as low as 30 per cent I have no accurate statistics over the past twenty years, but I am satisfied that deep vein thrombosis has been present in *all* cases of true venous ulcer Had I kept statistics I would not have been able to prove the point, since the average patient with an ulcer is an exceptionally poor witness Let us take it anyway that the very vast majority of such ulcers are post-thrombotic

In a practical manual, such as I hope this is, we could leave the matter there, if it were not for the need to know which part of the damaged deep system of veins is of most importance to us when it comes to treatment Thanks to venography and venous pressure tests it has become widely accepted that it is the damage to the *communicating veins which is the most important point as far as surgical treatment* is concerned We will, therefore, briefly discuss how this point was arrived at

(1) First Catchpole in Manchester, and later Cockett (1956) in London, were able to show by venography that within one or two years deep veins blocked by thrombosis were effectively recanalized

(2) Owing to the almost standard position of a venous ulcer it was noted that *they occurred where the main perforator veins emptied directly into the deep veins* at the ankle

(3) Regarding points (1) and (2), *many investigators, after testing the venous* pressure of the deep and superficial venous system, came to the conclusion that the *ulcers were due to a continuous local venous hypertension in the ankle area* This was sustained, and sometimes even increased, during exercise

(4) *If the " muscle pump " system* (*see* page 67) *is pathological in any way* the drainage of the superficial tissues is less efficient Normally the pressure in the superficial veins falls with exercise With post-thrombotic cases, however, there is no fall, and sometimes a rise in pressure This is caused by the incompetent valves in the ankle perforator veins allowing the high pressure in the deep veins to be transmitted directly to the superficial veins This causes a gradual dilatation of the subcutaneous venules (first shown by the " ankle flare ") The health of the tissues suffers from this sustained pressure and eventual tissue damage occurs This basic pathology of the venous ulcer is now widely accepted and is the result of the combined efforts of many workers throughout the world

Varicose veins, if sufficiently severe, might well cause a similar back pressure, damaging the superficial tissues in a like manner It is thought by most workers, however, that most " varicose ulcers " have a further factor in their causation, in other words they are usually associated with *incompetent perforators* I must say that although I find that quite a few varicose ulcers are cured by saphenous stripping only, on many occasions I do have to excise " blow-outs " at the same time

This is supported by Cockett's analysis of 54 cases of lower leg ulcer with incompetent lower saphenous veins In 36 (66 per cent) of these cases he was able to demonstrate incompetent ankle perforating veins (Dodd and Cockett, 1956)

This is a most instructive series It is well known that the fat patient ulcerates more readily than does the thin Cockett states The nutrition of the large amount of fatty subcutaneous tissue is poor and the addition of an increased local raised venous pressure may precipitate another tissue necrosing reaction This may result in a sudden massive fat necrosis "

I find this explanation of considerable interest, explaining something which one has always known but the reason for which was up to now obscure Gui de Chauliac (1300–1368) was as far as I can find out, the first to write that obesity and ulcers went together How pleased he would be to discuss the matter with Cockett in this century!

To what extent the lymphatic obstruction plays a part in the pathology of the venous ulcer is still not quite clear Although Kinmonth (1954) found that lymphangiograms were normal in deep vein thrombosis I cannot help feeling that there must be some lymphatic obstruction in the champagne bottle leg, where generalized constriction of the lower leg is caused by tight bands of fibrous tissue However this is probably of academic interest only

Any interference with the muscle pump action of the deep calf muscles must essentially hasten the onset of ulceration A stiff ankle or poor calf muscle development will make the normal return of blood from the lower leg more difficult This is an important factor in the conservative treatment of ulceration Massage and compression and mobilization of the ankle joint are all factors we discuss in the physical approach to treatment Additional or secondary factors in the causation of ulceration also have to receive consideration The following factors are sometimes present

(a) Infection (pyogenic or fungoid)
(b) Obesity
(c) Trauma
(d) Arterio-venous communications
(e) General diseases such as diabetes syphilis or anaemia.
(f) Constitutional skin diseases
(g) Pernio Bazin s disease acrocyanosis

These further and minor causes of ulceration are discussed elsewhere since it is all important to emphasize the primary cause at this juncture

Summary

The main points in the physiopathology of venous ulcers are as follows

(1) Deep vein thrombosis is a normal antecedent

(2) In spite of recanalization of the deep veins after a short period the leg may progress to ulceration The incompetent ankle perforator veins have been shown to have a marked effect in causing this

(3) The ankle perforators have been shown to pass directly into the subcutaneous tissues

(4) As a result of this local venous hypertension will occur and fat necrosis may follow

(5) True varicose ulcers may also have incompetent ankle perforator veins associated with incompetent superficial varices

(6) Both from the conservative and surgical point of view an understanding of this new concept is important Compression over the blow-outs, rehabilitation of the muscle pump and, if all else fails, surgery directed to the faulty ankle perforators are easy to understand if this pathology is accepted

THE DIFFERENTIAL DIAGNOSIS OF VENOUS ULCERS

The differential diagnosis of ulcers of the lower leg is usually easy It must be remembered, however, that ulceration due to venous insufficiency may occur in conjunction with other forms of ulceration and again that the causal oedema may be associated with general disease, such as the dropsy of cardiac disease



FIG 223 —Syphilitic ulceration of the lower leg This condition is becoming increasingly rare, but when associated with varices and varicose ulceration may be missed by the examiner unless he is on the look-out for it Syphilitic ulcers, as in this case, often have a "punched out" appearance and may present circinate or crescentic outlines They may occur anywhere in the leg and are not limited to the varicose ulcer area Pain is not a marked feature in syphilitic ulceration Other signs of syphilis may be found in a general examination It is said that the Wassermann reaction is not always positive in leg ulcers (Semon and Moritz, 1934) Periostitis of the tibia may occur secondarily to a varicose ulcer in a non-syphilitic patient, so that this sign is not necessarily of value in differential diagnosis

Before considering the rare types of ulcer in the varicose vein clinic let us very briefly enumerate the well-known characteristics of the venous ulcer

(1) A history of deep vein thrombosis is usually present

(2) Varicose veins may or may not be present

(3) Position always in the lower two-thirds of the inner leg or lower third of the outer side of the leg (*see* Fig 222)

(4) Evidence of a pathological venous system, either deep or superficial, or both Oedema, induration, cyanosis, an "ankle flare", pigmentation and eczema may all be present



(*a*)

A hypertensive ischaemic ulcer of one year's duration. The Wassermann reaction was negative and the blood pressure was 210 systolic and 115 diastolic. Excision and plastic closure healed the condition.



(*b*)

Varicose eczema



(*c*)

Erythrocyanosis. This condition is frequently seen in association with varicose veins.

The following are some of the other types of ulceration which are most likely to be seen in the varicose vein clinic None of these ulcers should cause the examiner difficulty so far as diagnosis is concerned

Syphilitic ulcers

These ulcers usually appear as nodules which break down and finally heal with atrophic scarring. They are usually multiple and may appear outside the varicose ulceration area (*see* Fig. 223) When in doubt blood tests are essential These ulcers are a rarity in Great Britain



FIG. 224—A tertiary syphilide of the leg which is atypical, and should be compared with Fig. 223 This condition occurring in association with varices may cause a difficulty in diagnosis if other signs of the disease have not been observed.

Ulcers of arterial disease

These ulcers are normally exceedingly painful and are associated with signs of circulatory deficiency The tests for these changes in the arterial circulation will be found on page 89 The location of the ulcers is often on the foot or on the toes Oedema and other signs of venous insufficiency are lacking.

Ulcerating tuberculides

Like syphilitic ulcers, this rare type of ulcer may occur anywhere in the limb and normally is found in both limbs at the same time The ulcers differ from the syphilitic ulcers in remaining unhealed indefinitely

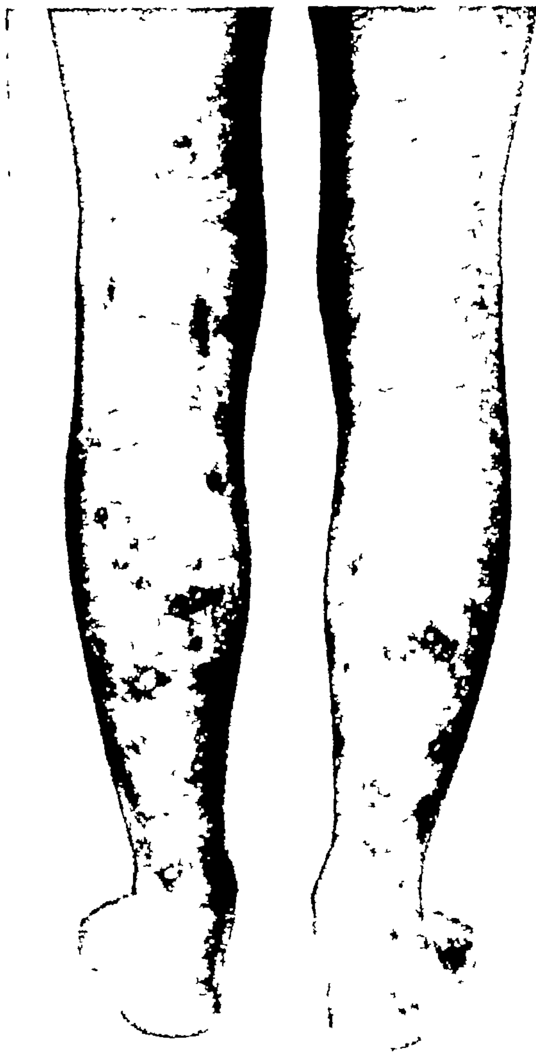


FIG 225 —A typical case of Bazin's disease In this case the associated varices have no place in the causation of the multiple ulcers, which, as is usual, are bilaterally symmetrical and mainly on the posterior surfaces of the legs Erythema induratum (Bazin's disease) may be distinguished from erythema nodosum since the latter usually affects the anterior surfaces of the legs, also the course is acute and ulceration is not usual The disease is self-limiting and clears up with rest These two forms of erythema are often seen in the varicose vein clinic and differential diagnosis is of much importance



FIG 226 —Ulceration from Bazin's disease associated with varices The essential requisites in a case of Bazin's disease are that the lesions should be bilaterally symmetrical with evidence of tuberculosis either past or present Patients are usually between the ages of 15 and 25 years and the classical place for the ulcers and rash is on the posterior aspect of the legs The condition usually occurs in girls and was originally referred to by Bazin as ' Erythème Induree de Scrofouleuse ' It may be said that Bazin's name is sometimes taken too lightly, and many cases of pernio and erythema nodosum are mistaken for this disease

Bazin's disease (erythema induratum)

These ulcers usually affect the calves rather than the varicose ulcer area. They resemble the ulcers of pernio but do not show the seasonal fluctuations (*see* Figs. 225 and 226)



FIG 227.—Severe varices showing a factitious ulcer above the knee. Prurigo nodularis (Hyde) is present. This condition shows itself by the presence of firm hyperkeratotic nodules which develop as the result of scratching. *In this case the* antecedent pruritus was due to the varices. The position of the ulcer rules out any gravitational causation.

Factitious ulcers

These must always be suspected in the hysterical type of patient, and in a large clinic such ulcers are not too great a rarity. Other signs of hysterical phenomena such as a "glove and stocking" distribution of anaesthesia may be present and the diagnosis may be clinched by placing an Elastoplast bandage on the limb

for a short period of time The occlusion causes immediate healing, since the patient is unable to cause further damage "Rub eczema" is often caused on the anterior aspect of the ankle, by the friction of the heel of the opposite limb These patients may show highly burnished nails from the same cause and call attention in this way to their aetiology The ulcer of the malingerer, although rare, usually presents a regular pattern and is in the position which is easily accessible to the patient In addition, there is a cause for the continuance of ulceration in the form either of a pension or other personal gain

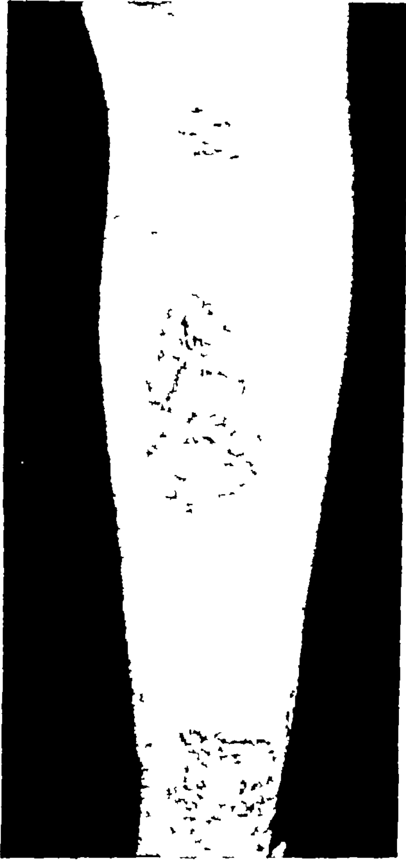


FIG 228 —A case of pustular psoriasis associated with varicose veins The character and distribution of the rash exclude the existent varices from its causation

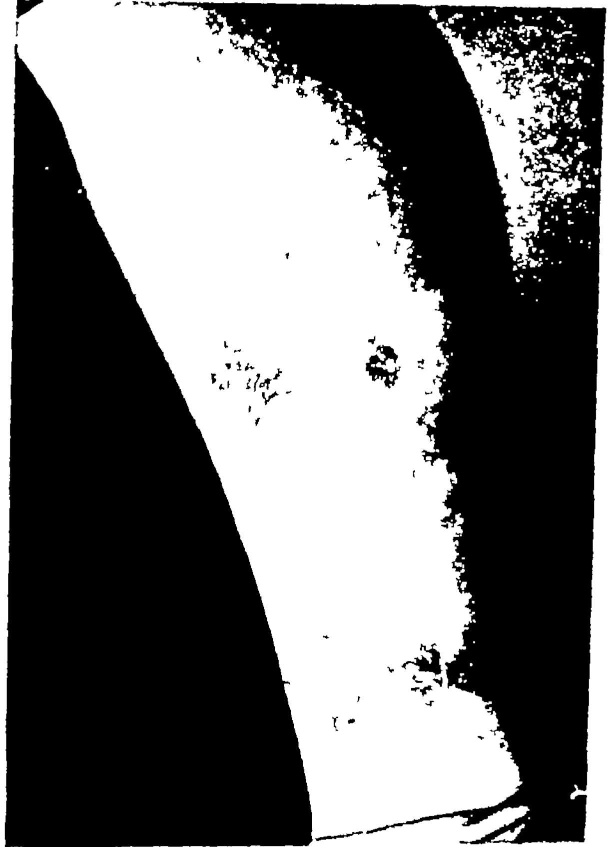


FIG 229 —The skin lesions of erythema nodosum which may occur in association with varicose disease The differential diagnosis is discussed in the text

Tineal ulcers

Mycotic ulcers are common and are often associated with tinea either between the toes or in the groin, although it must be noted that these ulcers often occur in the complete absence of tinea interdigitalis The ulcers have a "ringworm" arrangement and are multiple They appear as irritable blisters which finally burst, become secondarily infected and show a tendency to heal in the centre Patients suffering from varices seem to be particularly susceptible to this type of infection, but the correct treatment produces a speedy cure Remember that there is frequently a neurotic factor in the causation of tinea Highly nervous patients tend to sweat extensively in both hands and feet, and these are the two

situations which are so commonly the site of infection of either tinea or cheiropompholyx. For this reason treatment directed to the patient himself is of just as much importance as is local care. As a rule a course of luminal in combination with active occupation is helpful. The results of excessive scratching may be avoided by occlusion of the parts affected



FIG 230—Severe tineal infection of the foot. Varicose vein patients seem to be particularly prone to this infection which should always be looked for Eczematous patches and shallow ulcers in the lower leg which will not heal may be due to this infection, which can be so easily cured.

Pernio

These ulcers are usually seasonal in their appearance and exposure to cold is the common antecedent. Healing frequently leaves a pigmented area which is permanent. The skin is usually cold and cyanotic, slight oedema may be present and the ulcers are usually small and multiple, as many as 20 of different sizes sometimes being found in the ankle area. They are painful in their early stages The ulcer beds are red and purple. The seasonal occurrence of these simple ulcers is an important pointer in diagnosis In comparison with the ulcers of Bazin's disease the lesions of pernio are less inflamed and less active.

Acrocyanosis

This common condition will sometimes cause swelling and puffiness, but not a true oedema. As these patients frequently find their way to the varicose vein clinic it is as well that we should have a few notes about the condition The disease usually occurs in women and is associated with a continued coldness of the extremities which take on a bluish colour In warmer weather this bluish discoloration may become red. Ulceration and trophic changes do not occur in acrocyanosis. Test for arterial insufficiency will be found to be negative Treatment for this disfiguring complaint is on the whole unsatisfactory As in pernio

protection from cold is essential and much help can be gained from physiotherapy Some patients benefit by a course of Priscol and it is only in severe cases that sympathectomy is required In later life even without treatment the colour changes tend to lessen with some patients.

I have noted over the years that whereas the varix becomes worse in early pregnancy, the acrocyanotic limb may often improve For this reason I implanted *amnion* in a series of limbs Some of the patients were much improved Results were too variable, however, for us to recommend this treatment However, when stripping a limb which is the seat of both varicose and acrocyanotic trouble, the question of an amnion implant may be considered It can do no harm and on occasions the results are good It should be remembered that incompetent varices cause more symptoms in a limb which is the seat of what we might call the " pernio syndrome " than they do in an otherwise healthy limb.

Only the conditions seen frequently in a clinic are under discussion, although there are other rare conditions of academic interest only which might be included As previously mentioned, syphilitic ulcers have recently also become a rarity

Meleney's ulcer

These ulcers described by Meleney in 1949 are rare They are to be seen in patients suffering from severe constitutional disease such as advanced anaemia The ulcer is caused by a necrosis of the subcutaneous tissues which spreads rapidly, and causes an exquisitely painful ulcer, the edges of which are undermined The causal organisms (usually micro-aerophilic streptococci) react well to the use of antibiotics while the general health of the patient is being treated Remember that in a sick patient a painful, rapidly spreading ulcer with undermined edges may well be a Meleney ulcer

Other causes of oedema

In addition to the above, the examiner must always be on the look-out for other causes of oedema which may be present and which may be complicating the oedema due to chronic venous insufficiency Such conditions are (1) the oedema of congestive heart failure, (2) the oedema of chronic nephritis, and (3) chronic lymphoedema of various types

The oedema of congestive heart failure

This oedema affects both legs and may be present in other parts of the body Other signs and symptoms of uncompensated heart lesions are present.

The oedema of chronic nephritis

This oedema is also bilateral and symmetrical, occurring in other parts of the body as well as in the ankles It must be remembered that the above types of oedema may be associated with a chronic venous insufficiency which may be missed by a hurried examination

Chronic lymphoedema

This condition rarely ulcerates or gives rise to eczematous patches The differential diagnosis between the oedema of chronic venous insufficiency and chronic lymphoedema is frequently difficult In these patients the history is of

particular value, since in those cases suffering from venous insufficiency an antecedent cause of thrombophlebitis such as enteric fever childbirth or operation may be elucidated. The rapidity of the onset will be a further factor in influencing the diagnosis in this direction The patient with lymphoedema shows surprisingly few symptoms having regard to the hypertrophied limb In the later stages the thick skin and hard consistency of the tissues associated with advanced lymph oedema have little in common with the pitting of the soft oedema associated with ulceration and engorged varices are commonly found in those patients suffering from chronic venous insufficiency As pointed out elsewhere, lymphoedema and chronic venous insufficiency may both be present in the same limb the lymphatics becoming involved secondarily to acute thrombophlebitis In the presence of an indefinite history patients presenting two coexisting diseases may be a difficult problem in diagnosis

BIBLIOGRAPHY AND REFERENCES

Boyd, A. M (1950) Varicose Ulceration " *Brit med J.*, 2, 269

— Jepson, R. P., Ratcliffe, A. H., and Rose, S S (1952) "The Logical Management of Chronic Ulcers of the Leg." *Angiology* 3 207

Cockett, F B and Jones, D E. E. (1953) The Ankle Blow-out Syndrome A New Approach to the Varicose Ulcer Problem " *Lancet* 1 17

NEW REFERENCES

Bauer G (1951) "The Sequels of Post-operative Venous Thrombosis." *Congr Soc Int Chir Paris* 451

Boyd, A N Catchpole, B N., Jepson, R P and Rose S S (1953) "The Technique of Interpretation of Lower Limb Phlebography " *Ann Surg.*, 138, 726.

Dodd, H., and Cockett, F B (1956) *The Pathology and Surgery of the Veins of the Lower Limb* Edinburgh Livingstone.

Hojensgard, I C., and Stürup, H (1952) "Static and Dynamic Pressures in Superficial and Deep Veins of the Lower Extremity in Man." *Acta physiol scand.*, 27 49

Kinmonth, J B (1954) "Lymphangiography in Clinical Surgery and Particularly in the Treatment of Lymphoedema." *Ann R Coll Surg Engl.*, 15 300

Meleney F L. (1949) *Clinical Aspects and Treatment of Surgical Infections* Philadelphia Saunders

CHAPTER 16

TREATMENT OF THE INDURATED AND ULCERATED LEG BY CONSERVATIVE METHODS

SINCE this manual is essentially practical, I look upon the chapters on the treatment of the ulcer and the surgery of the varix as being the most important. I hope to make the essential points in this treatment of the ulcer as clear as possible, even at the expense of the reader feeling that some of the contents are too elementary.

When treating an ulcer remember that you would have no patients if they all walked on their hands, or even if they walked on all fours. In other words, all treatment is directed at reducing the high venous pressure in the lower part of the limb. *Persistent venous hypertension* when exercising is the cause of ulceration. How do we deal with this problem?

Elevation of the limb in bed

This treatment will heal nearly all ulcers in time. They will re-ulcerate when the limb is dependent unless they are then treated by compressive support. Surgery may also be a necessary adjunct.

I think that modern teaching has tended to stress compression treatment in the *early* stages of treatment, whereas much time could be saved if this form of therapy were delayed until the limb had been slimmed and partially healed by bed-rest. It is really an economic factor. Hospitals have no beds for such patients and few can afford the time and attention to carry out the treatment in bed at home. However, wherever possible, the limb should be prepared for subsequent treatment by a limited period of elevation in bed. Exercises must be carried out throughout the treatment, so that further risks of thrombosis may be avoided. Massage is most valuable if practicable.

Treatment by compression bandages

This treatment has been practised for centuries. The advantages of ambulatory treatment are obvious from both the patients' point of view and from that of economy.

Treatment by surgery

At some time during the course of treatment by bed or compression, surgery may be required. This may consist of

(1) Stripping the superficial varices.

(2) Grafting the ulcer site.

(3) Excision of faulty communicating veins by either the extra fascial or sub-fascial route

These then are the three basic methods of treatment available—bed, compression and surgery



FIG 231—A case of severe varicose eczema

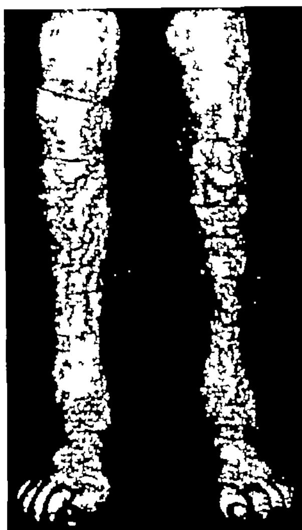


FIG 232.—The same limbs as shown in Fig. 231 after treatment by means of bed-rest, massage with crude coal-tar ointment and compression with a one way-stretch bandage. These limbs will be fit for surgical treatment as soon as the oedema has disappeared and the skin has become healthy

There are many adjuncts to treatment, such as

(a) The control of the infection in an ulcer

(b) Physiotherapy—especially massage

(c) The control of excessive weight

(d) The general treatment of the patient's health

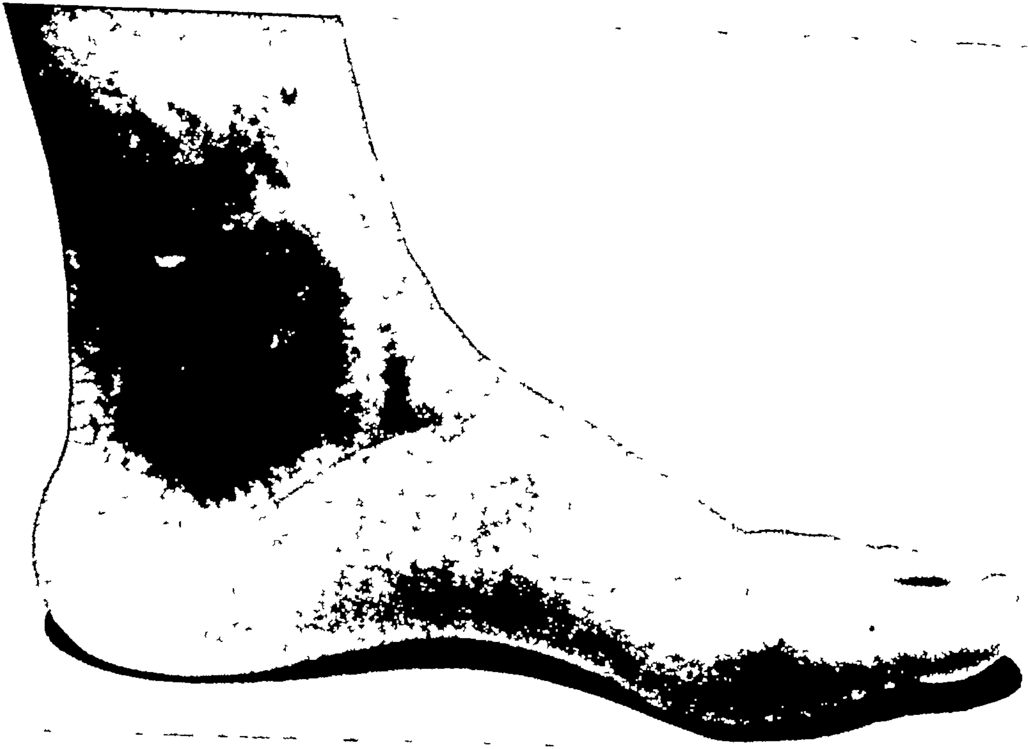


FIG 233 —A varicose ulcer of many years' standing showing marked pigmentation

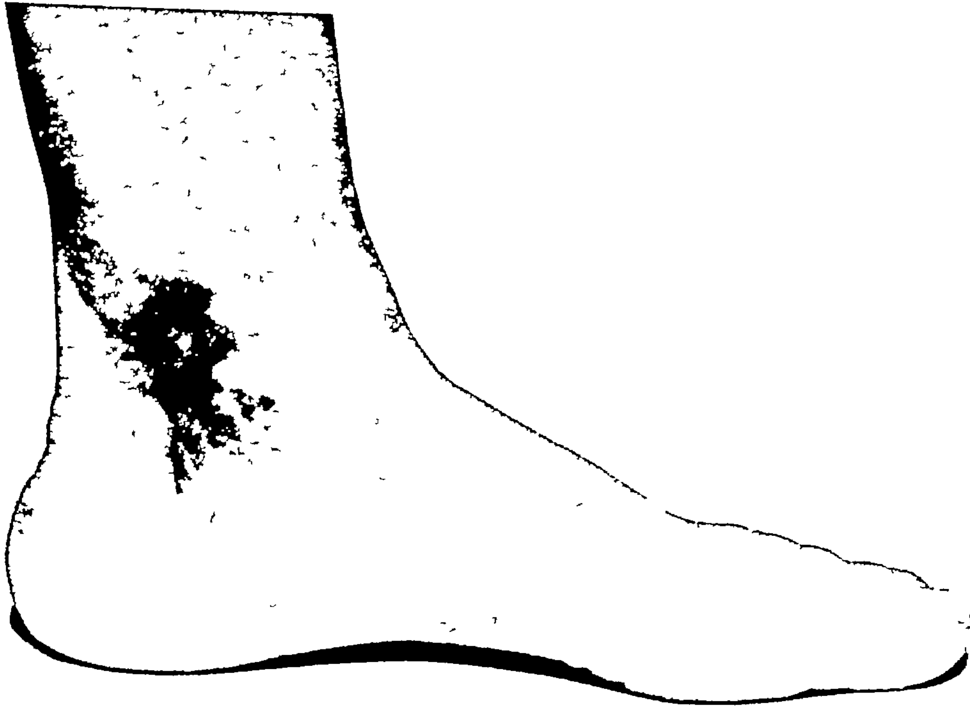


FIG 234 —The same case as Fig 233, nine months after operation This picture is shown to demonstrate the disappearance of the pigmentation This is unusual, and it is unwise to promise the patient that this discoloration will be likely to vanish after operation This ankle now demonstrates an "ankle blow-out syndrome", and at some stage it may be necessary to excise the local incompetent communicating veins Now that the ankle is slim the extra-fascial approach will have become quite a simple matter



Fig 235 —Healing varicose ulcers of the leg demonstrating the commonly associated condition of flat foot, which is probably due to the muscular atrophy so often found in the legs of subjects suffering from varicose veins. When this patient is under the anaesthetic, much benefit can be derived from manipulation of both the ankle and tarsal joints.



Fig 236 —These legs are in the pre-ulcerative state The common area for ulceration, the lower two-thirds of the inner border of the leg, is clearly demonstrated In order to make this a useful limb compression, exercises and massage will have to be given for a long time. The muscle wasting will be particularly benefited by the spring exercise



FIG 237 —A malignant ulcer of the lower leg Although this is a rare condition, when in doubt perform a biopsy

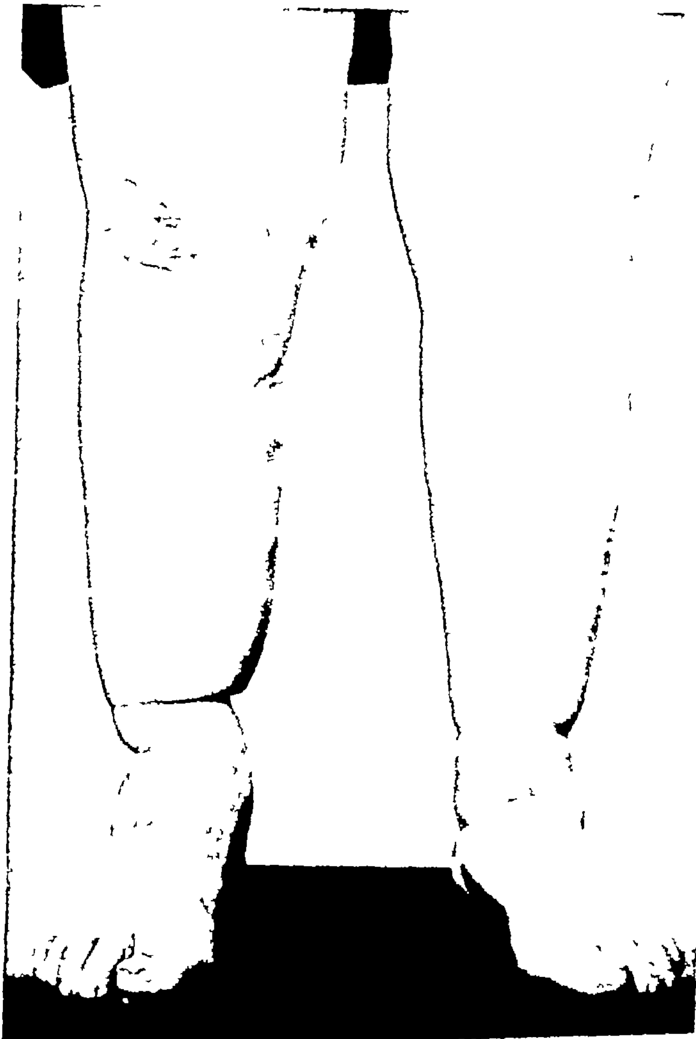


FIG 238 —An interesting patient who came to the varicose vein department This is not a cicatricial constriction from previous ulceration but an example of foetal dysplasia of the leg, due to amniotic constrictions Simple excision of these scars is not always successful and the method of Eckstein and Eckstein (1946) is well worth consideration



FIG 239 —Varicose ulceration. These ulcers were so painful that it was found necessary to encase the lower legs in plaster of Paris for 2 weeks. This procedure relieves the pain, but it is important that exercises should continue during this preliminary treatment, which is fortunately rarely required.

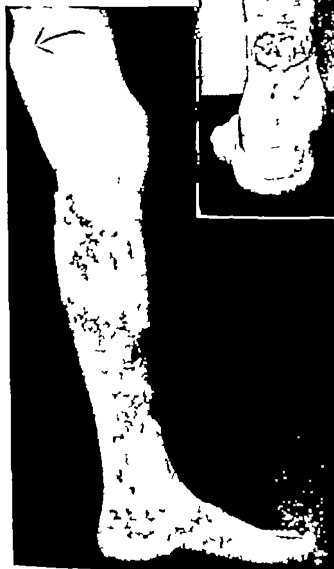


FIG 240 —This picture shows 2 common complications of varices. Marked pigmentation of the skin is present. Just below the knee a varix has burst leaving a small black ulcer The arrow points to the site of a previous ligation which needless to say was a useless treatment



FIG 241 —A severe varicose ulcer of 17 years' standing The muscle is exposed and the oedema of the ankle and foot is considerable The internal saphenous vein shows incompetence of the valves The patient was crippled and unable to continue her work as a restaurant owner



FIG 242 —The same case as Fig 241, 2½ months later The internal saphenous vein has been stripped, the ulcer has been grafted, and massage has been given to the entire limb Even after such treatment support is necessary, as is the alteration in the way of life

Treatment by compression

The supportive treatment of varices and their complications is one which has been studied throughout the ages. There is nothing new in the principle of compressive treatment for gravitational ulcers or of supportive treatment for uncomplicated varicose veins For example, in 1699 William Salmon makes some interesting remarks on the use of bandages

> These Medicaments be applied, according to the length of the Varix, binding it down with a part of a Reed tied fast thereupon, with a narrow Bandage and over all, a Hose or a Buskin, made out of Dog s skin which be put about and fastened about the Thighs by lacing it on "

So early as 1676 Richard Wiseman Sergeant Chirurgeon to King Charles II in his *Chirurgical Treatises* describes cases of varicose ulceration which were cured by a preliminary reduction of the swelling occasioned by having the leg rowled up with a Compress and Bandage from Foot to Gartering This surgeon further completed the treatment by means of a laced stocking Michael Underwood in 1783 in a *Treatise on Ulcers of the Leg* complains that compression by firm bandaging is as a general practice, so much out of fashion, though once in great esteem with eminent surgeons Underwood treated the condition by bandaging without rest or confinement of the patient Thomas Whately in 1799 in *Practical Observations on the cure of Wounds and Ulcers of the Legs without rest* describes 167 cases cured by means of compression and exercise. He states that this method has been brought into discredit because the principle of equable compression has not been correctly applied He points out that an ulcer will not heal unless the primary oedema is first removed and that failures are due to an inadequate application of the bandage Again quoting the words of Laurence Heister (1739)

> " Dionis here recommends a sort of Leathern Stockings, which, being tightened at discretion by the Lace are to be worn night and day Though the same stocking may be also conveniently made of strong brown Linen in the same form

The above extracts will show that supportive treatment was understood during the seventeenth and eighteenth centuries In the nineteenth century detailed advice is found in lectures by Sir Benjamin Brodie, showing that the modern uses of adhesive bandages and diachylon bandages together with the localized treatment of ulcers were well understood more than 100 years ago The allergic response of some patients to certain of the bandages was also understood

> The pressure of a common roller will do a great deal of good, and formerly nothing else was recommended But we find, now that in cases of varicose ulcer as in cases of indolent ulcer of the leg, you may very much assist the common roller by the addition of other means. One very good way of making pressure on a varicose ulcer is to interpose between it and the bandage a piece of lead sheet. It is common to employ stripes of linen spread with soap or adhesive plaster but on the whole the diachylon plaster is to be preferred, for both soap plaster and adhesive plaster will at times irritate the skin and bring on inflammation and pustules, while diachylon plaster scarcely ever produces this effect. "

As in the past we still use the bandage to obtain compression Fortunately we now have a selection of many types each of which is valuable in the different types of limb which we are called upon to treat The bandages fall into two main groups

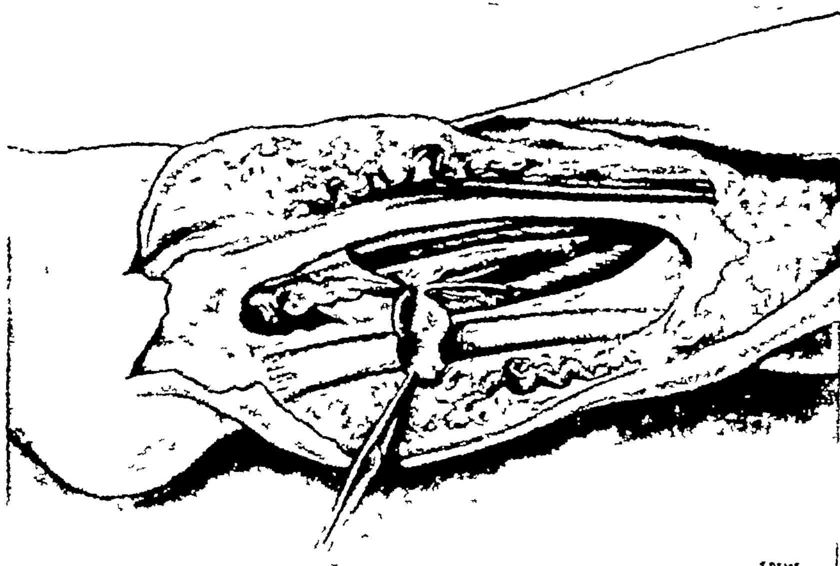


Fig 245 —Dissection of subcutaneous tissues of inner side of lower third of leg of a man who had had chronic varicose eczema of this region without any saphenous incompetence Deep fascia has been opened to show junction of large dilated incompetent middle perforating vein with posterior tibial vein Note (1) vein passing from perforating vein where it penetrates deep fascia, to soleus muscle, (2) great saphenous vein anteriorly, and (3) small dilated tortuous veins in subcutaneous tissues

(By courtesy of F B Cockett)



Fig 246 —A severe annular varicose ulcer Routine treatment may well be augmented by skin grafting A large ulcerated area like that which is shown in this case is unlikely to heal with a firm scar and will anyway form a protracted case so far as healing is concerned The methods of skin grafting are discussed in the text

Treatment by compression

The supportive treatment of varices and their complications is one which has been studied throughout the ages. There is nothing new in the principle of compressive treatment for gravitational ulcers or of supportive treatment for uncomplicated varicose veins For example, in 1699 William Salmon makes some interesting remarks on the use of bandages

> These Medicaments be applied, according to the length of the Varix, binding it down with a part of a Reed, tied fast thereupon, with a narrow Bandage and over all, a Hose or a Buskin, made out of Dog s skin, which be put about and fastened about the Thighs by lacing it on. "

So early as 1676 Richard Wiseman, Sergeant Chirurgeon to King Charles II in his *Chirurgical Treatises* describes cases of varicose ulceration which were cured by a preliminary reduction of the swelling occasioned by having the leg rowled up with a Compress and Bandage from Foot to Gartering This surgeon further completed the treatment by means of a laced stocking Michael Underwood, in 1783 in a *Treatise on Ulcers of the Leg* complains that compression by firm bandaging is as a general practice, so much out of fashion, though once in great esteem with eminent surgeons Underwood treated the condition by bandaging without rest or confinement of the patient Thomas Whately in 1799 in *Practical Observations on the cure of Wounds and Ulcers of the Legs without rest* describes 167 cases cured by means of compression and exercise He states that this method has been brought into discredit because the principle of equable compression has not been correctly applied He points out that an ulcer will not heal unless the primary oedema is first removed and that failures are due to an inadequate application of the bandage Again quoting the words of Laurence Heister (1739)

> Dionis here recommends a sort of Leathern Stockings, which, being tightened at discretion by the Lace, are to be worn night and day Though the same stocking may be also conveniently made of strong brown Linen in the same form. "

The above extracts will show that supportive treatment was understood during the seventeenth and eighteenth centuries In the nineteenth century detailed advice is found in lectures by Sir Benjamin Brodie, showing that the modern uses of adhesive bandages and diachylon bandages together with the localized treatment of ulcers were well understood more than 100 years ago The allergic response of some patients to certain of the bandages was also understood

> The pressure of a common roller will do a great deal of good, and formerly nothing else was recommended But we find, now that in cases of varicose ulcer as in cases of indolent ulcer of the leg, you may very much assist the common roller by the addition of other means. One very good way of making pressure on a varicose ulcer is to interpose between it and the bandage a piece of lead sheet It is common to employ stripes of linen spread with soap or adhesive plaster but on the whole the diachylon plaster is to be preferred, for both soap plaster and adhesive plaster will at times irritate the skin, and bring on inflammation and pustules, while diachylon plaster scarcely ever produces this effect "

As in the past we still use the bandage to obtain compression Fortunately we now have a selection of many types each of which is valuable in the different types of limb which we are called upon to treat The bandages fall into two main groups

(1) The sticky or wet bandages such as Elastoplast or Viscopaste

(2) The dry elastic bandage such as the one-way or two-way-stretch dry elastic bandages (Bell and Croyden) and the heavy cotton elastic bandage type (Elastoweb)

These two groups of bandage are used for two totally different methods which may be summarized as follows

(1) *Occlusive method* (using Elastoplast technique)

(2) *The dry elastic bandage method* used in conjunction with physiotherapy and compression pads of polyurethane foam

These two techniques will be considered separately

The occlusive method

Indications

All venous ulcers or indurated legs may well be treated by this method The Elastoplast bandage which is in general use for this occlusive treatment is especially useful for the hospital type of patient One of its main virtues is that it cannot be removed by the patient at will Even the most stupid of patients will gain benefit from the compressive value of this bandage and will have to persist with treatment because he cannot tamper with it

Types of bandage

The Elastoplast type of sticky bandage has the most valuable "stretch and regain" properties not found in alternative diachylon bandages For this very reason elastic pressure can be delivered to the leg to the maximum The sustained pressure to the limb squeezes out the oedema and gives firm support, helping the calf muscle pump in its work (*see* Chapter 4, page 67) The ulcer under layers of Elastoplast, in the words of Dickson Wright "stews in its own juice" In a remarkable way the ulcer steadily heals with a healthy granulating surface Pain after the first forty-eight hours diminishes and finally disappears Antibiotics and antiseptics find but a small place in treatment when this occlusive method is used It has to be technically correct, however, and it is amazing that in spite of Baynton's instructions (*see* Chapter 2, page 23) nearly 200 years ago, it is seldom that one finds a patient attending the clinic whose Elastoplast bandage has been properly applied Dickson Wright re-introduced Baynton's instructions 30 years ago and has taught his methods universally, but it is, I am afraid, still necessary to give the various methods of Elastoplast application in detail This bandage is not the only one to be used in occlusive therapy In my opinion based on many years of practical use, I still feel that, used correctly, it is the best and if I had the choice of one adhesive bandage only, I should select the Elastoplast type This I firmly believe after trying all the other types I therefore intend to discuss the varied methods of using it and will leave the discussion of alternative bandages to the section dealing with allergy to Elastoplast

Remember, whenever applying any type of bandage to the lower limb, that it is to the ankle and lower third that you apply the maximum compression As the bandage ascends, the pressure is gradually relaxed This maxim, stressed by Benjamin Brodie (*see* Chapter 2, page 24) is all important and cannot be restated too often It is the lower third of the leg which needs the most support, whether,



FIG 247 —Multiple post-thrombotic ulcers. *The patient was intelligent* and was therefore treated by means of one-way-stretch compression over a polyurethane pad. In addition, exercises and massage were given daily and three weeks later the limb was nearly healed, as shown (Fig. 248)

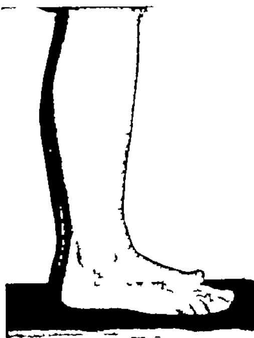


FIG 248 —When this limb is completely healed and soft, any obvious ankle blow-outs should be excised extra-fascially through small incisions, and the patient will only lose a few days from work.



FIG. 249 —Severely indurated legs in a grossly overweight woman. Treatment is of little avail until extensive weight reduction is achieved. In other words, until the patient becomes active and mobile once again, compression and massage will be of little value

as we shall see later, the bandage is applied from the foot upwards, or downwards from the knee

Prior to the application of the Elastoplast bandage, wherever possible the patient goes to bed with the limb elevated During this time exercises along the lines described later in the chapter are prescribed At the same time the ulcer is cleansed with Eusol dressings, etc When the oedema has subsided considerably we have reached the ideal time for the application of the pressure bandage This preliminary



FIG 250—The right limb was the seat of deep vein thrombosis resulting from multiple ligations and the injection of sclerosants The limb is pre-ulcerative, and prolonged physiotherapy and compression are required *before* serial stripping can be performed

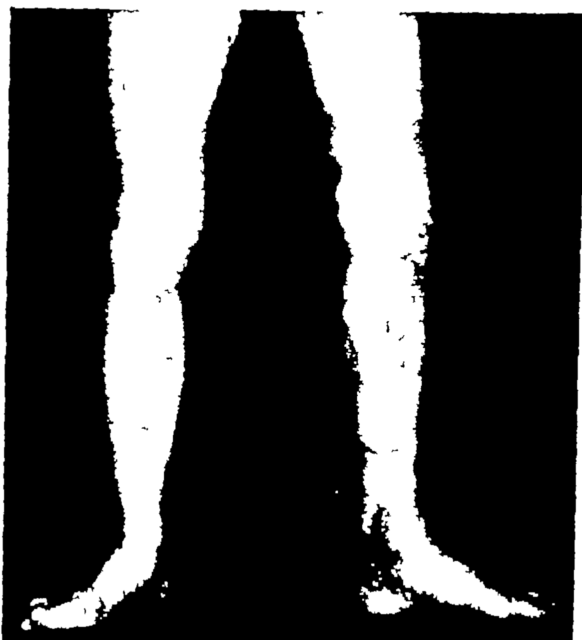


FIG 251—Another shapeless and pre-ulcerative limb, which requires the benefits of physiotherapy prior to operation This limb was made safe for surgery within six weeks of starting treatment

removal of the massive oedema is economical as far as bandages are concerned, since frequent renewals during early treatment would otherwise be necessary

If the limb is hairy shaving is necessary Actually, most legs which are the seat of venous deficiency are hairless, so this preliminary is seldom required Whether there is a field for the study of alopecia in this observation, I do not know.

In the presence of considerable discharge from the ulcer the skin may be protected by painting it with 2 per cent gentian violet in water, or a solution containing equal parts of Ichthyol and water Once the leg is on its way to becoming slim the Elastoplast bandage may be applied as in Fig 252 This picture shows the application of the four lateral strips of Elastoplast prior to winding the bandage as demonstrated Note that throughout the application the foot is kept at a right angle, so as to prevent rucking The bandage must be applied firmly with plenty of overlap especially in the lower third of the limb If necessary a second bandage may be applied over the first This may be necessary in a fat oedematous limb, in order to give added support and to prevent bulging of the tissue between the bandage turns

Fig. 252 should be self-explanatory as far as standard application is concerned Practice is essential however and no nurse should be allowed to undertake this duty until fully trained. Faulty application (*see* Fig 268 *a–e*) can not only prevent good results but may be disastrous in causing further ulcers or in interfering with the arterial supply to the foot A modification of what we may call

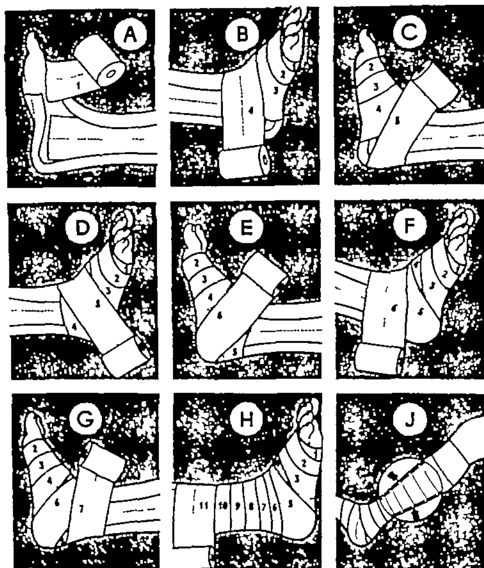


FIG 252.—The application of an Elastoplast bandage.

the standard method of application is shown in Fig 253 This method is useful if there is much discharge from the ulcer since it can seep through the punctures in the Elastoplast bandage into a pad of wool over the apertures This pad of wool can be changed as often as is necessary without the disturbance of the original bandage

These then are the standard methods of Elastoplast bandage application and I have found these bandages to be most valuable There are surgeons however

such as Dodd, who states "These latter (Elastoplast) are *not* recommended as they cause severe skin sensitivity reactions in about a quarter of the patients" (Dodd and Cockett, 1956)

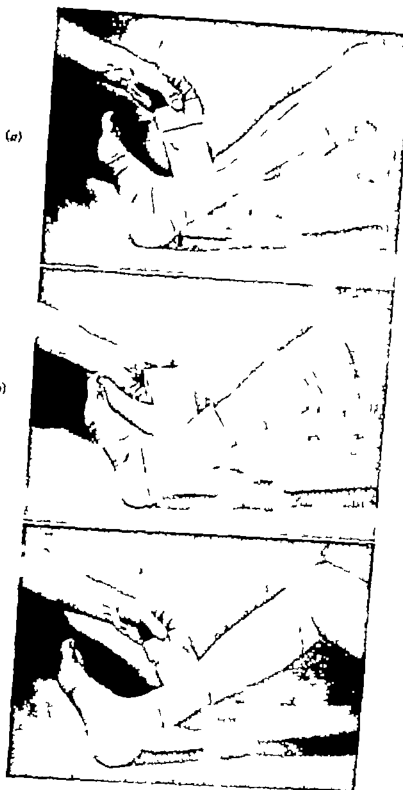
Ever since Dickson Wright proved the advantages of compression bandages a quarter of a century ago I have used them on many thousands of limbs. Allergy to the Elastoplast spread does occur. In my experience, however, this reaction affects less than 3 per cent of limbs, and the advantages of using this bandage far outweigh the results from occasional sensitivity. If the bandages are not put on



FIG 253—A pad of wool is placed over the punctures in the Elastoplast and held loosely in place with a further piece of bandage. This dressing can be removed by the patient and renewed whenever necessary without disturbing the main bandage.

firmly enough reactions will be common. Sweat retention and retention of excessive discharge will determine this point. Again, they should not be used in the allergic type of patient. Asthmatics, neurotics and those subject to eczema and urticaria are not suitable candidates. Besides this group there is the patient who is allergic to Elastoplast only. As a rule he knows this, and will tell you that plaster gives him a rash. For this reason, I still say that provided you exclude the obvious allergic patient and provided you apply the bandage properly you will have very few allergic responses, and you will have the advantage of a bandage which gives true compression. I have quite given up the use of the soap, lead and resin (diachylon) plasters, since they lack elasticity. Furthermore, most "allergic" patients will react just as severely to this type of bandage spread as they will to Elastoplast.

Many cases of so-called *Elastoplast allergy* are not in fact genuine, since the dermatitis is more often than not due to the seepage of discharge under a too loose Elastoplast bandage. These discharges are in close contact with the skin and produce a local irritation. This point is mentioned since in order to avoid excessive reaction in these cases it is essential that all Elastoplast bandages should be



(a) and (b) A method of applying Elastoplast in the presence of a discharging ulcer. The discharge will seep through the holes cut in the bandage into the wool pad depicted in (b), which is held in place by a single strip of Elastoplast. This method allows the patient to renew the wool pad at will without disturbing the firm compression given by the underlying adhesive bandage. (c) The application of an elastic adhesive bandage over an Unna type bandage. This method is of use when the skin is hypersensitive to the spread of the elastic adhesive bandage.



An allergic response to the application of an elastic adhesive bandage This need not occur, and ways by which it may be avoided are explained in the text (*see* page 280)

applied with considerable firmness In so doing the number of allergic reactions will be reduced and it will soon be realized that the case which is truly allergic to this bandage shows generalized symptoms such as a rash over other parts of the body In fact allergy to the bandage should not be diagnosed unless such a rash and reaction are present Patients who dislike the application of an Elastoplast bandage are very prone to give a lurid description of the damage their skin has suffered from a previous application

The makers of the Elastoplast bandage have gone to great trouble over the question of allergy and those interested in the subject should read the research done by Russell and Thorne (1955)

" Patch tests —the application of small pieces of Elastoplast to the skin in order to test sensitivity—are not always reliable and I have given up using this test If you are satisfied that the patient is allergic to Elastoplast then use one of the following methods

(1) Elastoplast over tubular gauze
(2) Elastoplast over Coltapaste or Viscopaste
(3) Crêpe bandages over Coltapaste or Viscopaste
(4) Diachylon bandages

These alternative occlusive methods will be illustrated for your better under standing

If all forms of occlusive compression bandaging are contra indicated the alter native is to use the *dry elastic bandage* method As a general rule I find the most satisfactory and economic method of treating a venous ulcer to be the one detailed as follows

(1) Short preliminary rest in bed
(2) Occlusive ambulatory bandage therapy
(3) Dry elastic bandage compression in conjunction with physiotherapy

Sometimes the order of treatment has to be altered according to circumstances but all methods are illustrated in this manual and the reader must work out his own preference for this

There is no doubt that the treatment by means of the dry elastic bandage is immensely preferable to all other methods if the patient is trustworthy and will definitely follow instructions This is my method of selection whenever possible. The occlusive bandage (Elastoplast) however still finds a place with the hospital type of patient

Occlusive treatment in the presence of allergy to Elastoplast

Crêpe bandage over Viscopaste or medicated bandage

Some limbs are allergic to Elastoplast even if alternatives are placed between the skin and the Elastoplast In such a case if occlusive treatment is still desirable it is better to use a *crêpe* or Elastoweb type of bandage over the medicated bandage Figs 254 and 255 illustrate this method of application

The tubular gauze method

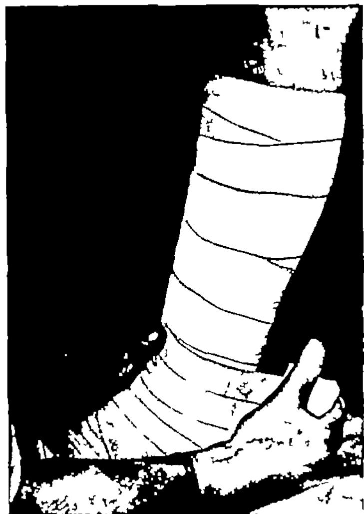
The application of a stockinet bandage under the Elastoplast is necessary in all cases where the skin is sensitive to the Elastoplast spread As many layers may be

FIG 254 —An oedematous, eczematous leg with a poor skin covering This limb may well be treated by means of Unna's paste until the skin is sufficiently healed to allow the application of an elastic adhesive bandage, by means of which greater compression may be given



(a)

FIG 255 (*a*, *b* and *c*) —A method of applying a Viscopaste bandage or Unna's plaster to the leg The soaked bandage may be rubbed on the skin of the leg before starting this application, using the bandage as a paint brush The bandage is allowed to fall naturally on any part of the leg No crease of the material must occur, and the bandage should be wound round the leg and cut every time there is the risk of rucking The cutting may be done by the patient herself in order to leave the operator with free hands About 5 thicknesses of the bandage should be applied and a *crepe*



(*b*)

Fig 255—*continued*

bandage should be firmly superimposed so that the paste oozes through this outer covering (*see* (*c*)) The *crêpe* bandage may be removed after a month or two when it becomes loose The cast may then be painted with Unna s paste and a further *crêpe* bandage applied without removal of the original cast. The boot gives firm support to the oedematous limb together with the emollient action of the zinc content and the antiseptic action of the phenol It has stood the test of time and is still invaluable for the suitable case.



(*c*)

FIG 254 —An oedematous, eczematous leg with a poor skin covering This limb may well be treated by means of Unna's paste until the skin is sufficiently healed to allow the application of an elastic adhesive bandage, by means of which greater compression may be given



(*a*)

FIG 255 (*a*, *b* and *c*) —A method of applying a Viscopaste bandage or Unna's plaster to the leg The soaked bandage may be rubbed on the skin of the leg before starting this application, using the bandage as a paint brush The bandage is allowed to fall naturally on any part of the leg No crease of the material must occur, and the bandage should be wound round the leg and cut every time there is the risk of rucking The cutting may be done by the patient herself in order to leave the operator with free hands About 5 thicknesses of the bandage should be applied and a *crêpe*

FIG 255—*continued*

bandage should be firmly superimposed so that the paste oozes through this outer covering (*see* (*c*)) The *crêpe* bandage may be removed after a month or two when it becomes loose The cast may then be painted with Unna's paste and a further *crêpe* bandage applied without removal of the original cast The boot gives firm support to the oedematous limb together with the emollient action of the zinc content and the antiseptic action of the phenol It has stood the test of time and is still invaluable for the suitable case

(*b*)

(*c*)

applied as thought necessary. Fig 256 shows the bandage being put on by means of the special Scholl's applicator Fig 257 shows the application of the Elastoplast over the stockinet In order to keep the Elastoplast clean, as an added refinement the stockinet bandage can be drawn down to the foot after the sticky bandage has been applied



FIG 256 —Bandage being applied with closed end over toes



FIG 257 —Elastic adhesive bandage being applied

Elastoplast over Coltapaste or Viscopaste

Many limbs allergic to Elastoplast are compressed with comfort by this method I reserve the Coltapaste bandage for the limb with dry scaly eczema, and the Viscopaste for the wet type of eczema Coltapaste may cause an allergic response, as will almost any medicament, when used for the dry eczema so often seen in the senile limb It will often, however, remove trouble which has been present for very many years It may be applied by placing many longitudinal strips to the limb, which are then massaged into place, forming a comfortable dressing without creases or rucks



FIG 258 —The application of a diachylon bandage This should be applied firmly to the limb after slight warming in cold weather Vertical strips of bandage may be used with advantage as when Elastoplast is employed.



FIG 259 —The application of a reversed elastic adhesive bandage (starting from the knee and going down to the foot) over a Ceraban bandage which has been previously warmed and applied firmly to the oedematous limb This combination of bandages not only gives firm support to the limb but is also of value when the patient is allergic to Elastoplast. Allergy to the Ceraban bandage is rare but the author has come across a few cases where the patient was tolerant of Elastoplast but reacted severely to Ceraban.

applied as thought necessary Fig 256 shows the bandage being put on by means of the special Scholl's applicator Fig 257 shows the application of the Elastoplast over the stockinet In order to keep the Elastoplast clean, as an added refinement the stockinet bandage can be drawn down to the foot after the sticky bandage has been applied



FIG 256 —Bandage being applied with closed end over toes



FIG 257 —Elastic adhesive bandage being applied

Elastoplast over Coltapaste or Viscopaste

Many limbs allergic to Elastoplast are compressed with comfort by this method I reserve the Coltapaste bandage for the limb with dry scaly eczema, and the Viscopaste for the wet type of eczema Coltapaste may cause an allergic response, as will almost any medicament, when used for the dry eczema so often seen in the senile limb It will often, however, remove trouble which has been present for very many years It may be applied by placing many longitudinal strips to the limb, which are then massaged into place, forming a comfortable dressing without creases or rucks



FIG 258 —The application of a diachylon bandage This should be applied firmly to the limb after slight warming in cold weather Vertical strips of bandage may be used *with advantage, as when Elastoplast is employed.*



FIG 259 —The application of a reversed elastic adhesive bandage (starting from the knee and going down to the foot) over a Ceraban bandage which has been previously warmed and applied firmly to the oedematous limb This combination of bandages not only gives firm support to the limb but is also of value when the patient is allergic to Elastoplast. Allergy to the Ceraban bandage is rare but the author has come across a few cases where the patient was tolerant of Elastoplast but reacted severely to Ceraban

Diachylon bandages

For those interested, I append two illustrations (Figs 258, 259) for the use of these "lead–soap–resin" bandages These appeared in the first edition of this manual some ten years ago I feel I should relegate them to the historical chapter, since they are the original methods of Baynton However, they are still used by some even in these days They have little use as far as I am concerned, since they lack the essential "stretch and regain" properties of the Elastoplast, and can so

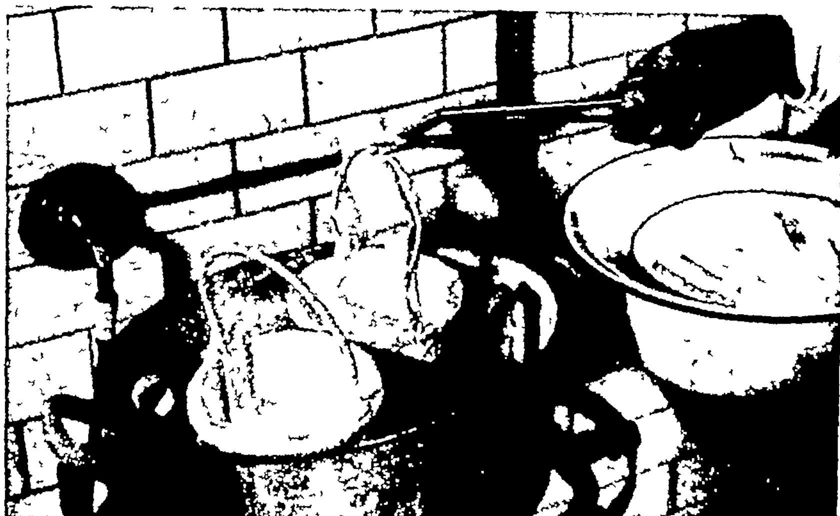


FIG 260 —Unna's paste boot Gauze rolls, 6 inches in length, are soaked in a warm solution of Unna's paste which is being heated in a water bath This is a somewhat tedious method of making an Unna's paste boot but it is well worth the trouble since a far more resilient and elastic supportive covering can be made in this way The Viscopaste bandage is a more practical method for use in the surgery since no heating is required and the procedure is less messy However, the end-result is not so satisfactory Unna's paste bandage is also referred to as the zinc glue or zinc gelatin bandage The formula is

Zinc oxide	6 66 oz	Gelatin	9 33 oz
Glycerin	540 00 ml	Phenol	4 00 ml
Water	800 00 ml		

easily be replaced by the modern methods we now employ with the Elastoplast in the presence of allergy

These then, are the main methods I use for occlusive compressive therapy The Viscopaste bandage which we have discussed has evolved from the old Unna type of bandage (*see* Fig 260) This bandage has been impregnated with various medicaments by the manufacturers Sometimes these *medicated bandages* are useful in recalcitrant cases of eczema The Dalzoband is a convenient way of applying either ichthyol, urethane or coal-tar in a convenient form If compression is needed it may be applied over these medicated bandages conveniently by means of the Elastoweb bandage

The dry elastic bandage technique (modified Bisgaard)

Indications for use

All patients who have undergone occlusive therapy with the sticky bandage will in the course of time be candidates for treatment with the dry elastic bandage

Furthermore the more intelligent the patient, the earlier she may be released from the unpleasant sticky bandage technique to the dry bandage There are many occasions when we can dispense with the sticky bandage altogether After a preliminary bed rest, if the limb is not too swollen and the ulcer is not too large, we can start straight away with a dry elastic bandage The patient however must be

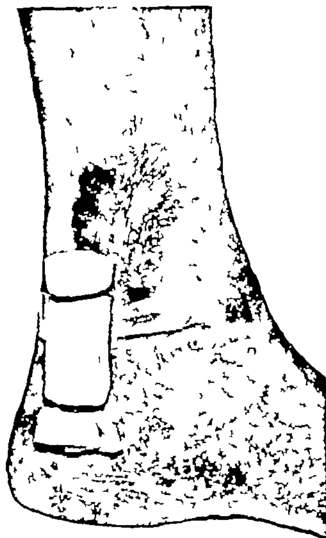


FIG 261 —A roll of polyurethane held in position with a piece of cellulose tape When the dry elastic bandage is superimposed, spongy pressure is produced behind the internal malleolus.

sufficiently intelligent and interested to follow out the instructions The advantages of this form of treatment are obvious

The dry elastic bandages of the one-way-stretch and two-way stretch type give a firm even compression if properly applied and have the great advantage of being removable at night for the bath and for the application of any medicaments which may be considered necessary for the case The patient wearing this bandage avoids the unpleasantness of a noisome discharge seeping through the sticky bandage day and night The great disadvantage with a bandage which can be removed by

the patient is that unless she has adequate intelligence she is apt to leave it off or re-apply it incorrectly in a haphazard manner For this reason, although it is of great use in supportive treatment, it has its limitations from the therapeutic angle when used by the hospital patient of poor mentality

Localized pressure treatment may be given by means of pressure pads. The particular use of this localized compressive treatment is found in the treatment of

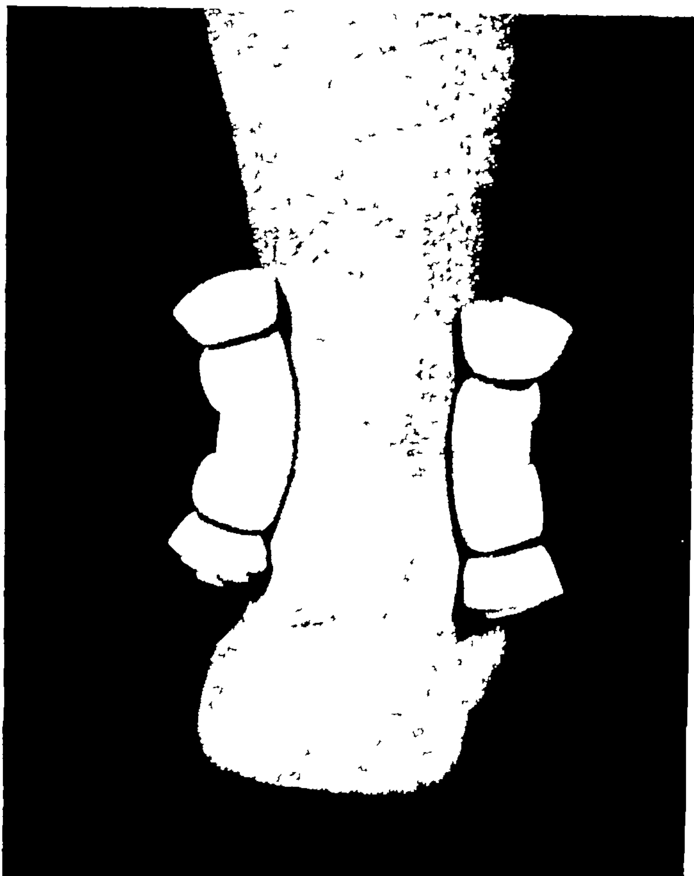


FIG 262 —Two polyurethane pads in their correct position behind the malleoli, in the area described by Bisgaard as the "coulisse"



FIG 263 —A method of securing a plastic foam pad to a wide area of induration It is secured by means of cellophane tape prior to the application of the one-way-stretch bandage The shape of the pad can be made to fit the condition The pad may be sterilized by boiling, and may be impregnated with solutions directed towards healing, if required

ulcers which cannot be directly influenced by the spiral bandage used alone Those ulcers found just behind the malleolus require pad treatment, and this may be given in the form of polyurethane foam pads As soon as the oedematous lips of the ulcer have been flattened out and healing is under way the pads may be discarded This is direct pressure treatment to the ulcer base Pads are more frequently required, however in those areas upon which the bandage pressure fails

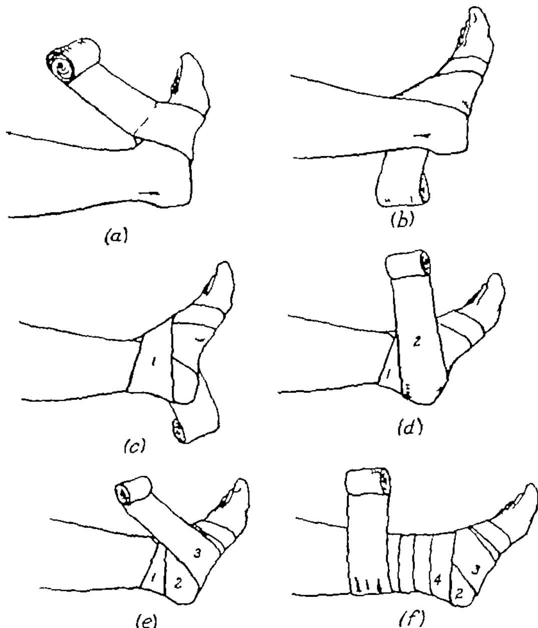


FIG 264 —The application of the dry elastic bandage of either the one way-stretch or two-way-stretch type. Note that after the application of the loop (*a*) the first turn is made round the ankle (*b*), the second turn over the point of the heel (*c* and *d*) and the third and fourth turns (*e* and *f*) serve to prevent slipping of the turn made round the heel Throughout the application the bandage is kept fully stretched and the tension is not relaxed during the application to the lower third of the leg. In the presence of induration, it is wise to overlap the bandage so that further pressure may be given to this area

to fall, in other words, in the hollows between the tendo achillis and the malleoli. Rolled pads in this position are illustrated in Figs 261–263 In the old days we used felt, Sorbo rubber and sponges in order to get pressure in different places Polyurethane foam, however, is very superior It is soft, resilient and can be easily sterilized Furthermore, it is cheap and if necessary can be charged with medicaments before application to the ulcer bed

There are many types of dry elastic bandage on the market The one-way and two-way-stretch types (Bell and Croyden) which I introduced sixteen years ago I use for preference, since the tension, in my opinion, is just right Heavy cotton elastic bandages of various types are now available, however, and although the pressure they give is not so satisfactory they have the advantage of being cheap



FIG 265 —*Demonstration of the first turn of the* Elastoweb *bandage*

The good bandage gives a steady squeezing action to the limb, and supplies what I call " bandage massage " when the patient is walking

The general principle in the bandage application is the same Maximum compression over the lower third of the limb gradually reduced until it ends below the knee is the routine The method of application is explained by Fig 264 An alternative type of foot loop is demonstrated in Fig 265 This type of loop *makes* the patient take the first turn round the ankle Also many patients find it to be more comfortable The main advantage of dry elastic bandage therapy lies in the fact that the limb may be massaged throughout treatment The main points regarding this massage are discussed in the section under physiotherapy (page 295)

THE APPLICATION OF THE ONE-WAY AND TWO-WAY-STRETCH BANDAGES

As already pointed out, the tension of the bandages can be varied by the patient to suit the condition, but the correct application is of the utmost importance Patients learn to apply these bandages themselves provided they are properly instructed in the first place The two-way-stretch bandage is the heavier and

stronger of the two and it will be noted that when it is pulled out it does not lose width The lighter one way stretch bandage is useful in the treatment of milder forms of oedema The instructions for the application of either of these bandages are as follows

(1) The loop must be placed over the foot at the level of the base of the big toe

(2) The bandage must be well pulled out during application and the first turn is made round the ankle

(3) The second turn is made around the point of the heel

(4) The third and fourth turns lock the second turn into position (*see* Fig 264 *e* and *f*)

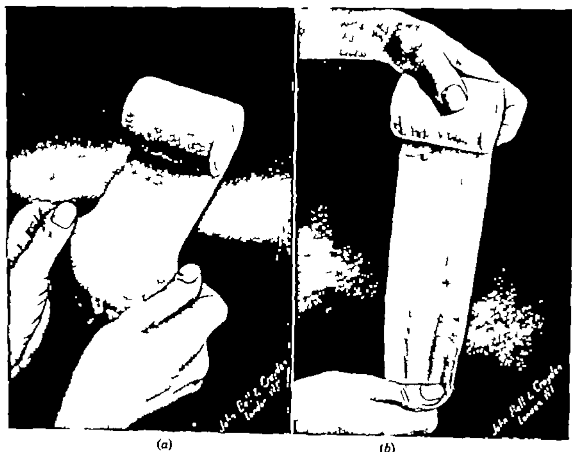
(5) The lower third of the leg needs the maximum support and the bandage should be overlapped in this area

(6) The upper two-thirds of the leg should not be bandaged too firmly and in this area the bandage must always be slackened off

(7) The bandage may be washed in lukewarm soapy water but frequent washing affects the bandage in time It may be dried at a safe distance from a fire

(8) It is advisable to remove the bandage once or twice during the day and to re-apply it after exercise

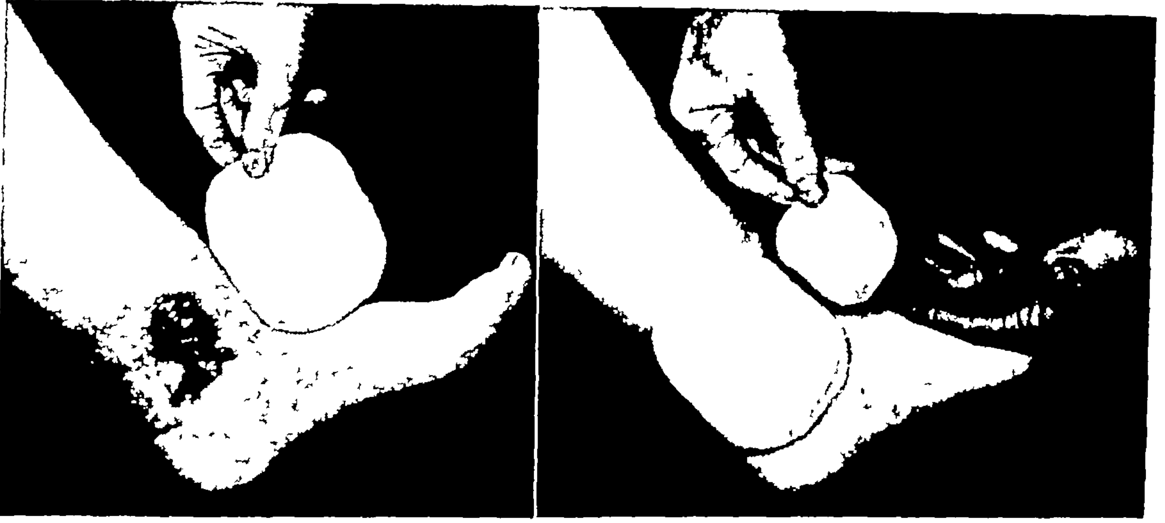
(9) The bandage must never be worn at night and if the wearer is sedentary for any length of time occasional movement of the limb is necessary so that the circulation may be stimulated



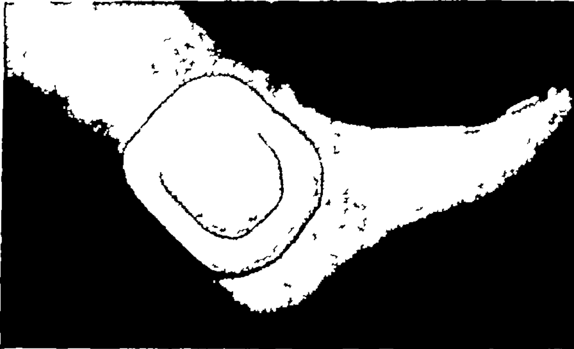
(*a*) (*b*)

FIG 266 —(*a*) A two-way-stretch bandage invaluable in compressive treatment (*b*) this picture demonstrates the double elasticity of the bandage which when stretched out does not lose width

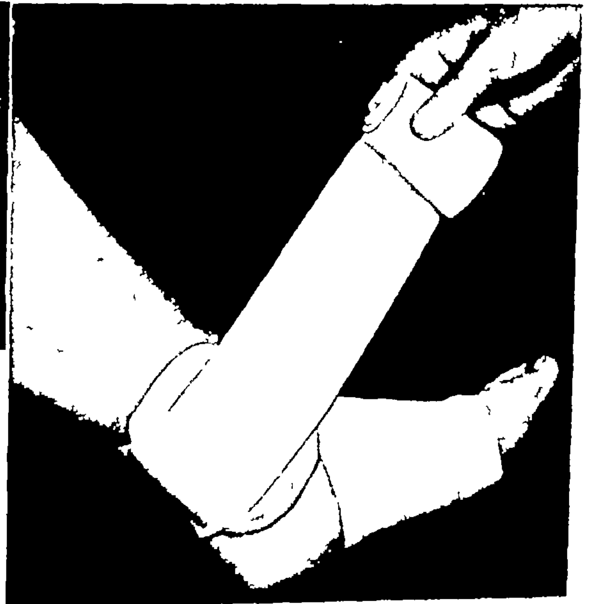
A modification in the method of applying this bandage has recently been suggested. If a small slit is made in the bandage about six inches from the loop and the first turn is made over the point of the heel, which is allowed to protrude through this slit, bandage slip is minimized.



(a) (b)



(c)



(d)

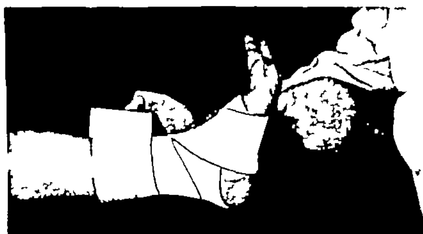
FIG. 267.—Use of felt compression pads in the treatment of a malleolar ulcer. An ulcer in this position is difficult to compress by means of a spiral bandage alone. A felt or Sorbo pad fitted over this area will bring localized compression to bear where it is needed. In this case carefully chamfered pads are being placed over the ulcers, (d) shows the final application of the spiral bandage. For some time now we have used only plastic foam pads, but there may be some readers who prefer this alternative of felt or Sorbo rubber.

These bandages have a very great advantage over those of pure rubber which are used in so many clinics, since they are aerated and when properly applied are not too unsightly. The stockinet tubular bandage is useful in that it gives firm compressive treatment and is cheap. It is of particular use in the hospital type of patient who requires supportive treatment for a limb which is eczematous and when frequent washing of the bandage is necessary. *Crêpe* bandages are of little value because they lose their elasticity so quickly.

FIG 268—**Faulty bandaging** HOW NOT TO APPLY AN ELASTOPLAST



(*a*) The foot in an equinus position and the bandage is being started too far away from the toes.



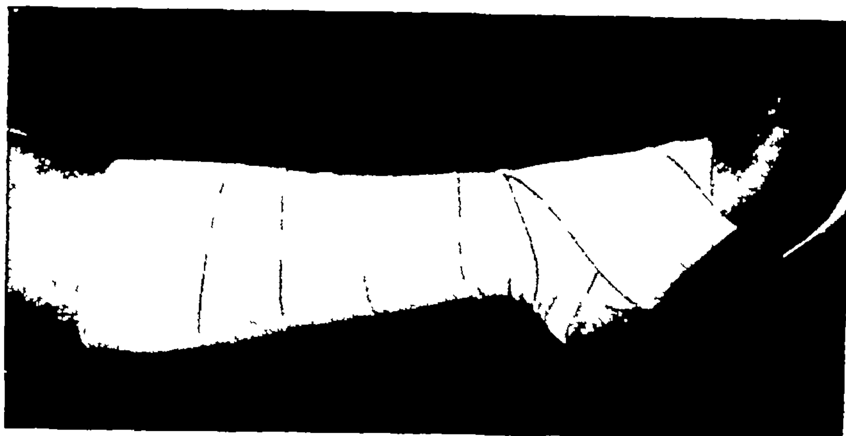
(*b*) The ridges around the ankle have been occasioned by subsequent dorsiflexion of the foot The heel has been left uncovered and the ankle is lacking in firm support.



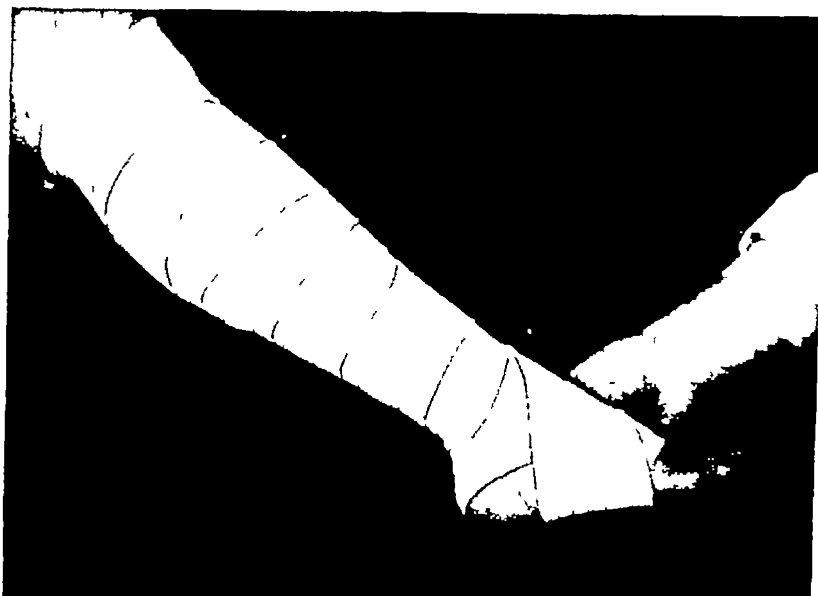
(*c*) The bandage has been insufficiently overlapped and will give inadequate support.

[*Continued overleaf*

FIG 268—*continued*



(*d*) A badly applied bandage which finishes too low on the limb



(*e*) This bandage has been carried far too high up the limb which is a particularly bad fault since on flexing the knee pressure will be brought to bear on the popliteal vein

ADVICE TO PATIENTS WEARING ELASTOPLAST BANDAGES

Should the bandage become uncomfortably tight, elevate the limb or lie on your back and do bicycle riding exercises in the air

If the bandage gets too loose, come up to the hospital to have it reapplied

Do not take off the bandage yourself If it is too tight, or if you are worried, come up to the hospital

A very few patients suffer from acute irritation under the bandage and sometimes a rash If this happens, you must report to the hospital immediately

Do not get the bandage wet

Do not sit in front of the fire unless the limb is protected from the heat by a blanket

If the ulcer discharge seeps through the bandage, wipe it off with some Dettol solution Then apply a pad of cotton-wool and a cotton bandage and change daily

Put an old stocking over the bandage at night This will stop the bandage from rucking

Combined use of stocking and bandage

A combination of the use of the elastic stocking and the elastic bandage is frequently required The patient is told to pull the elastic stocking on first thing in the morning and when about the house to give herself a few hours compressive treatment with the bandage over the stocking She can remove this when going out, and this combination of supportive treatment will very often keep a patient in a comfortable state even if suffering from quite a severe degree of oedema. Just like the diabetic, the patient must be taught to look after herself and the more intelligent soon find that they are able to control their symptoms by the proper use of the various measures suggested

The general principle in the application of all bandages to the lower limb is as follows. Pressure is required essentially in the lower third of the leg, and this pressure should be gradually relaxed as the bandage ascends In this way during walking exercise the blood is assisted in its upward path in the compressed vein All bandages must be applied with care and every patient using an elastic bandage should be made to apply it herself before leaving the consulting room Unless this precaution be taken the good effect of the bandage will rarely be seen since the average patient is concerned only with applying the bandage so that she is comfortable In the words of Dickson Wright, it is harder to apply a bandage correctly than to remove a gall bladder



FIG 269 —The bandage is being held incorrectly for proper application.

Physiotherapy as an adjunct to treatment

In the treatment of the indurated limb physiotherapy and massage, together with active and passive movements, are amongst the most important weapons in producing renewed health to the damaged limb

It is interesting to know that exercises and massage entered into Chinese medicine in the days of Hua To (A D 115–205) "The used doorstep never rots and it is much the same with the human body The ambulatory treatment of leg ulcers is an interesting sequel to the findings of the ancients

Detailed instructions regarding the physiotherapy of the indurated limb are given in a small manual published by Messrs Livingstone *The Physical Treatment of Varicose Ulcers* Here will be found exact details directed to the physiotherapist and nurse In this chapter however it is only proposed briefly to discuss the main principles of physiotherapy which are as follows

(1) Massage
(2) Movements (a) passive (b) active
(3) Electrical adjuncts to treatment

Massage

There can be little doubt that the part played by the physiotherapist in the treatment of the indurated limb is of the utmost importance This is now becoming generally recognized, and a great debt is owed to Bisgaard for originating the method we now use

It must be stressed that massage is *in no way a substitute* for compression therapy, but it is a most valuable adjunct Properly applied, it can assist the venous drainage of the leg, remove oedema, soften induration and rehabilitate the

Bisgaard's Cardinal Manoeuvres



FIG 270—The leg is elevated so that the calf either rests on the physiotherapist's hand, or is elevated on the special couch The plantar plexus is emptied by rapid sweeping strokes of the palm from the anterior to the posterior part of the sole of the foot

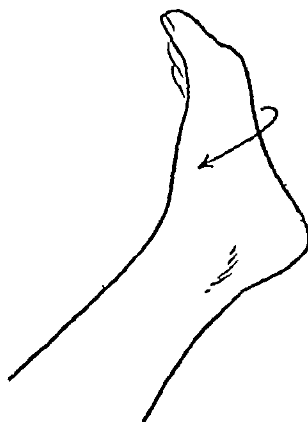


FIG 271—As described by Bisgaard, "the plexus calcanei is emptied by strokes from the surface of the calcaneus up towards the internal malleolus"

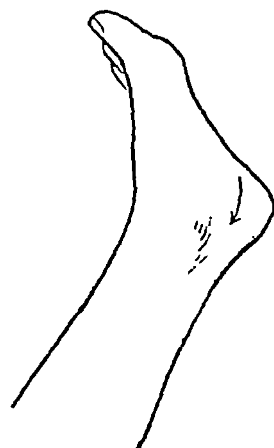


FIG 272—Again as described by Bisgaard, "the anterior part of the internal and external coulisse is caught between the thumb and index finger Rapid firm strokes posteriorly outwards and upwards along the Achilles tendon At this time the nature and degree of the infiltrations is ascertained"

calf muscle pump by mobilization of the tarsal, ankle and knee joints It cannot do these things by itself, however, compression and active exercises remain the sheet anchor of treatment

The technique of massage is based on Bisgaard's three cardinal manoeuvres which are best shown by the diagrams in Figs 270–272 It can be seen that the basic principle of all these manoeuvres is directed towards emptying the blood from the foot and lower leg, sweeping it back towards the heart (Fig 270) Prolonged and strenuous kneading of the tissues is required along the lines of Bisgaard, who was the first to point out the importance of "massage by reverse movements" In other words, the physiotherapist moves her hand *against* the movements of the tendons and muscles The massaging hand moves upwards while the muscles and tendons move downwards owing to the active movements of the ankle joint This, in the words of Bisgaard, "puts the infiltrations under double fire"

The brawny induration around the ulcer can be softened and dispersed by firm deep massage with the thumbs as shown in Fig. 274.

Finally, the masseuse can be of the greatest assistance in the help she can give towards mobilizing the ankle joint and so encouraging the full use of the calf muscle pump.

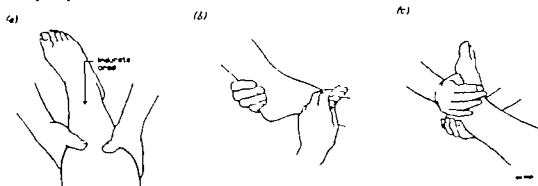


FIG. 273.—Some methods of massaging the indurated leg. (*a*) The leg is elevated and stroking movements are made from the ankle upwards. (*b*) active kneeding of the area behind the malleoli is given whilst the ankle joint is moved up and down. (*c*) deep massage is particularly applied below the internal malleolus which is the commonest seat of ulceration. Massage given to the thigh muscle is also of importance in improving the circulation.

The main difficulty facing the surgeon is not *whether* to use massage but *when* to use it. Naturally, every case must be judged on its merits, but generally speaking the time for massage is once the ulcer has become clean, oedema has lessened, and the discharge has cleared up. Once compression treatment and active

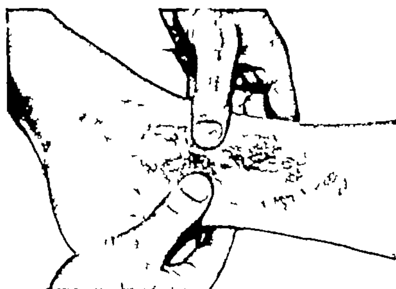


FIG. 274.—Loosening the fibrous tissue surrounding the ulcer

exercises have begun to restore a more normal venous circulation, diligent massage given in the correct manner speeds the process of healing immensely.

It must be repeated again, however, that *only the patient's own efforts* will produce the desired results.

Movements of the limb

Passive movements

Passive movements can be made by the masseuse, an example of whi shown in Fig 275 In this case the physiotherapist is rotating the mid-t joints She will also free the ankle joint at the same time The latter joi frequently partially ankylosed in the presence of ulceration, and we have found a degree of shortening of the tendo achillis After treating the joints the further duty of the physiotherapist to teach the patient to walk correctly, s



FIG 275 —A high grip of the foot, which is so valuable in rotating the mid-tarsal joints

bad habits so frequently develop during the painful period of ulceration Th who have suffered from ulceration for a prolonged period sometimes develo painful sacro-iliac joint which prevents them from taking active exercise Un these circumstances expert manipulation of the joint will help the patient to w correctly once again

Active movements

Active movements in the treatment of the indurated limb are probably the m important single factor in the improvement of the damaged circulation Chapter 7 of the small manual *The Physical Treatment of Varicose Ulcers* all th exercises are described in detail Examples may be seen in Figs 276–2 These exercises are directed at strengthening the muscle pump and freeing t joints Modified exercises made to suit the strength and age of the patient described in the above book, and will not be mentioned in detail in this chapt

The physiotherapist must influence the patient to become active once aga Other things being equal, the patient may be encouraged in swimming exercis dancing, running up and down stairs, and in fact doing anything which w increase the sluggish circulation Most of the exercises are better done weari the dry elastic bandage, giving the advantages of compression at the same tim



FIG 276—Ankle circling exercise While sitting down with the legs crossed the foot is slowly circled This exercise is most useful for developing the calf muscles and mobilizing the ankle joint, and can be performed at any time. The patient should be persuaded to concentrate on obtaining the maximum degree of joint movement possible



FIG 277—Heel and toe exercise. By alternately pressing the heel and toe hard down on the floor the patient is putting the "calf muscle pump" to work Venous stagnation in the lower leg is thus avoided This simple exercise can be performed at any time, and the patient should be taught to do it regularly if periods of prolonged standing are unavoidable

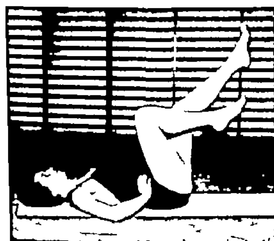


FIG 278.—Bicycling in the air exercise *This is perhaps the most useful exercise of all* for draining venous blood from the legs. The patient lies on her back and circles her legs in the air as if riding a bicycle. She must be taught to "use the pedals" by full ankle movements, and in severe cases a dry elastic bandage should be worn. Older patients may find it easier to perform the exercise with one leg at a time

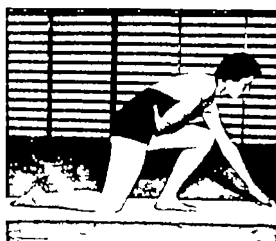
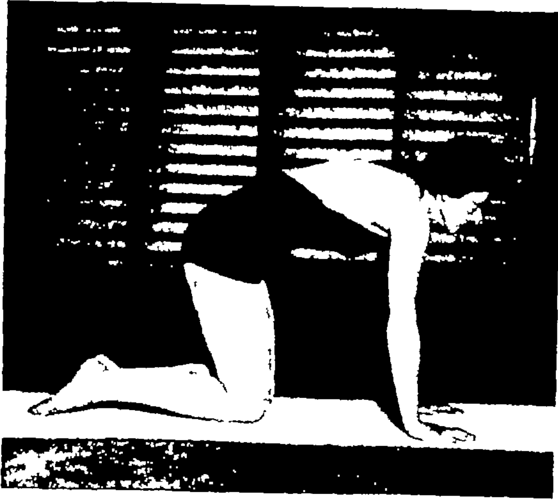


FIG 279—Half-kneeling, forward-bending exercise. A useful exercise for mobilizing a stiff ankle joint. The foot of the affected leg (in this case, the left) must be kept flat on the floor when reaching forward



(a)



(b)

FIG 280 —A useful exercise for freeing a stiff ankle joint and strengthening the leg muscles



FIG 281 —The double knee bend This exercise is of considerable value, but of necessity should be reserved for the younger and more active patient



FIG 282 —Exercise against spring resistance The employment of a gadget is often a useful subterfuge to persuade the otherwise idle, sedentary patient to exercise his legs A spring of 25 lb tension is usually most suitable, and the patient must be taught to move the ankle fully as in the bicycling exercise

Rather than describe each particular exercise, on pages 299 and 300 we show a series of pictures of physical exercises which we find the most suitable for the condition The reader can either add to these or modify them as he sees fit

The physiotherapist is in a position to influence the patient since she spends much time with her, and by means of encouragement can turn a fat, indolent, lazy patient into a slim, active one with a will to get better In other words, her duty lies in gradually teaching the patient to develop a normal existence Too frequently the patient has rested for long periods of time, allowed her muscles to become flabby, and has been frightened to undertake active physical exercises It is only by so doing that she will eventually either wholly or partially restore the normal physiology of the circulation of her leg

Electrical adjuncts to treatment

Electrical adjuncts to treatment are again discussed fully by Miss Wareham of St Bartholomew s Hospital in *The Physical Treatment of Varicose Ulcers* It is not often that we need electrical adjuncts but there is no doubt that there is a place for the following

(1) Ultra violet light

(2) Surging sinusoidal treatment or faradism under pressure

(3) Ultra-sonic therapy

(4) Short wave diathermy with inductothermy coil

(5) Ionizations

Ultra-violet light is sometimes valuable in the treatment of heavily infected or indolent ulcers since it has a stimulating effect and causes a hyperaemia It also has a bactericidal action

Sinusoidal treatment helps in the absorption of oedema.

Ultra sonic therapy has been a great help not only in this direction but also in the hastening of the absorption of haematomas

Short wave diathermy may be useful in causing vasodilatation and increasing the suppleness of tissues It should not be used however in cases where arterial deficiency is suspected

Further aids for the ulcer patient

Compression and *exercise* are the two really important factors in healing ulcers Both these measures must be followed energetically to obtain healing of the ulcer but even the most co-operative patient must rest sometimes For this purpose the *special relaxing chair* (*see* Fig 191) is of the greatest value both during and after treatment By tipping the chair backwards the legs are elevated sufficiently to encourage the venous return to the heart, and oedema can be more easily dispersed

The judicious use of a *stool* or *shooting stick* can be a great help to those who have to stand for long periods either indoors or outdoors

Elastic stockings give excellent elastic support but cannot provide the powerful compression necessary for healing ulcers Similarly they are not adaptable to the variation in size of the limb during treatment. Therefore their place lies in the after treatment of the healed ulcer The stockings *must* be tailored to fit each individual limb and that limb must be completely free of oedema at the time the measurements are taken Generally speaking women require full length stockings and even half length reaching to just below the knee

There are many excellent makes of elastic stockings on the market nowadays but my preference is for the strong two-way-stretch of the Superlastic type (*see* Fig 283) This combines very firm and lasting compression and is to my mind the best type available today Elastic net stockings are very liable to lose their stretch rapidly and are rarely strong enough to provide more than cosmetic support. Such is the vanity of the female mind however !

With modern materials even the strongest elastic stocking need not look cumbersome and for men coloured elastic stockings are obtainable thus obviating the need for an oversock

As has already been mentioned, the dry elastic bandage can be worn over the stocking for periods during the day should extra compression be required

After-care of the healed ulcer

Once the ulcer is healed, it is difficult to persuade the patient that treatment must not be relaxed She must be made to realize that the venous circulation of the leg has been permanently damaged By her efforts the ulcer has been healed



(a) (b)

FIG 283 —(a) The full-length seamless two-way-stretch elastic stocking This type of stocking is more suitable for women, and modern manufacture of certain types has made them sufficiently strong not only to give support but also a degree of compression (b) The heavy two-way-stretch short stocking This is a type usually recommended to men and can be obtained in the form of coloured socks, so that no oversock is required This is an improvement not only from the aesthetic point of view, but also from that of comfort

but if she throws caution to the winds it will recur Prevention is always easier than cure

The patient must now be taught what I call "a new way of life" This consists in following a series of simple instructions in order to combat the deep venous incompetence which she still has as a permanent legacy

Since no patient will ever remember spoken instructions, I make it a rule to give them all printed sheets covering all details of the after-care As these are

self-explanatory I make no apology for reprinting them in full here hoping tl some reader may find them useful

INSTRUCTIONS TO BE GIVEN TO THE PATIENT TO PREVENT ULCERATION

1 The more the limb is kept raised the less likelihood is there of swelling : ulceration Whenever you sit down elevate your leg on a footstool or chair

2. Do *not* stand more than you can help Walking, cycling and exercises are gc in moderation, but always wear your supports when so doing.

3 Always wear the supports—elastic stockings and/or O W.S /T W S bandage wl standing. Remove bandages if resting for any length of time. The time may co when your improvement will allow you to do away with the bandage support.

4 Stockings should be put on before leaving your bed in the morning. 1 bandages grip quite well over the stockings, which should be renewed every 6 mont

5 Exercises lying flat on your back are good Riding a bicycle " exercise in t position is especially valuable. Midday and evening are the best times for exercis

6. Learn how to apply the elastic bandages correctly Unless they are put properly and removed at intervals as is necessary you will do yourself more harm th good.

7 Use the special chair for as long as you can every day If you have not got t chair arrange a couch so that the feet are above heart level. Short rest periods 15 minutes every few hours are advisable

8 The bed should be raised on blocks (about 12 inches) at night. Pillows un the limbs are of no use.

9 Measure the maximum girth of the leg occasionally to check whether the treatm you are having is keeping the limb slim and so avoid the inevitable complaints neglect.

10 Self massage of the limb from below upwards is beneficial and Nivea crean helpful.

11 Do not scratch the leg, and avoid sunburn

DO NOT RELAX treatment without prior consultation Remember that YOU c keep your leg free from ulceration

INSTRUCTIONS TO BE GIVEN TO THE PATIENT WITH AN ULCERATED OR INDURATED LE

If your leg is ulcerated, or in a pre ulcerative hardened condition there are cert rules which you must obey in order to get better

You must learn " *a new way of life* " Success in treatment depends upon y entirely

Firstly your circulation must be improved. EXERCISES are all important. T minutes lying on your back and " riding a bicycle " with the affected limb in the must be practised Remember to use the pedals " so that the calf muscles tense a drive the blood up the limb You can also learn certain exercises which can be do when you are sitting still in your chair A few minutes two or three times a day is that is necessary

Secondly MASSAGE from a physiotherapist until all hardness has gone from yc limb is essential You can also learn self-massage and rub your leg from toe to kr with firm sweeping strokes.

The *third* important factor in treatment is to make the dropsical fluid leave your l This can be done by two methods. Firstly the correct application of the DRY ELAS BANDAGE before you get out of bed This squeezes the fluid and blood from the lov part of your leg. The bandage must be put on correctly must be removed at midd and reapplied and finally must be removed at any time when you are sleeping or restu

BIBLIOGRAPHY AND REFERENCES

Annan, J L (1945) "Varicose Ulcer" *Med Pr*, **214**, 187

Anning, S T (1949) "The Aetiology of Gravitational Ulcers of the Leg" *Brit med J*, **2**, 458

— (1952) "The Cause and Treatment of Leg Ulcers" *Lancet*, **2**, 789

Barrow, D W (1948) *Clinical Management of Varicose Veins* New York, Hoeber

Bauer, Gunnar (1951) "The Sequels of Post-operative Venous Thrombosis" *Congr Soc Int Chir*, *Paris*, 1951, 451

Bertwistle, A P (1941) "Treatment of Varicose Ulcer with Eczema" *Brit med J*, **1**, 818

— (1943) "Bone Changes in Varicose Ulcer" *Lancet*, **1**, 142

Birger, I (1941) "Ulcus cruris" *Nord Med*, **10**, 1240

Boyd, A M (1950) "Varicose Ulceration" *Brit med J*, **2**, 269

— Jepson, R P, Ratcliffe, A H, and Rose, S S (1952) "The Logical Management of Chronic Ulcers of the Leg" *Angiology*, **3**, 207

— *et al* (1953) "Major Venous Ligation in the Treatment of Post-Phlebitic Sequelae" *Lancet*, **2**, 113

Brain, R T (1950) "Causes and Treatment of Eczema" *Brit med J*, **1**, 717

Brewer, A C (1951) (Letter) *Lancet*, **2**, 177

Cockett, F B, and Jones, D E E (1953) "The Ankle Blow-Out Syndrome A New Approach to the Varicose Ulcer Problem" *Lancet*, **1**, 17

Cohen, M H, Thomas, H B, and Kalisch, A C (1943) "Hypersensitivity Produced by the Topical Application of Sulphathiazole" *J Amer med Ass*, **121**, 408

Coombs, J N (1940) "Varicose Veins and Ulcers" *Amer J Surg*, **50**, 741

Crivelli, L P U (1932) "Skin Complications of Varicose Ulcers" *Med J Aust*, **1**, 435

Davies, J H T, and Drynan, A E (1930) "Chronic Ulcer of the Leg Treated by the Method of Dickson Wright" *Brit med J*, **2**, 998

Deville, P M (1930) "Treatment of Varicose Ulcers" *Brit med J*, **2**, 1000

Dodd, H (1948) "Lumbar Sympathectomy for Varicose Ulcers" *Brit med J*, **2**, 532

— and Cockett, F B (1956) *The Pathology and Surgery of the Veins of the Lower Limb* Edinburgh, Livingstone

Eckstein, H, and Eckstein, F M P (1946) "Foetal Dysplasia of Leg, New Operative Approach" *Lancet*, **1**, 51

Eidinow, A (1937) "Ultra-violet Irradiation in the Treatment of Varicose Ulcers, Eczema, and Veins" *Brit med J*, **1**, 16

Foote, R R (1944) *Varicose Veins, Haemorrhoids and Other Conditions, their Treatment by Injection* London, Lewis

— (1947) "The Bandage in Varicose Conditions" *Practitioner*, **158**, 60

— (1958) *The Physical Treatment of Varicose Ulcers* Edinburgh, Livingstone

Glasser, S T (1939) "Sarcomatous Degeneration in a Varicose Ulcer" *Amer J Surg*, **43**, 776

Heller, R E (1943) "Pathology and Treatment of Indolent Ulcers of the Leg" *Surg Gynec Obstet*, **7**, 77

Hilton, J (1892) *Rest and Pain A course of lectures on the influence of mechanical and physiological rest in the treatment of accidents and surgical diseases and the diagnostic value of pain* Ed by W H A Jacobson 5th ed London, Bell & Sons

Homans, J (1917) "The Etiology and Treatment of Varicose Ulcer of the Leg" *Surg Gynec Obstet*, **24**, 300

Isaak, L (1940) "Effective Treatment of Varicose Ulcers of the Leg" *Arch Derm Syph Chicago*, **41**, 530

Lee, M (1953) "Varicose Ulcers" *Practitioner*, **170**, 288

Linton, R R, and Hardy, I B (1948) "Post-Thrombotic Syndrome of the Lower Extremity" *Surgery*, **24**, 452

Lockhart-Mummery, H E, and Smitham, J H (1951) "Varicose Ulcer, a Study of the Deep Veins with Special Reference to Retrograde Venography" *Brit J Surg*, **38**, 284

Lovell, D L (1945) "Penicillin in Ulcers of the Lower Extremity" *Arch Surg, Chicago*, **51**, 22

Lowenfeld, W (1926) "Zur Behandlung varikoser Unterschenkel-geschwure" *Wien klin Wschr*, **39**, 1278

Mahorner, H (1949) "Indurated Leg and Leg Ulcers" *Surg Gynec Obstet*, **88**, 115

Meyer, O (1946) "The Fallacy of the Term 'Varicose Ulcer'" *Industr Med*, **15**, 689

Monro, A K (1951) "Applying Streptomycin to Gravitational Ulcers" *Brit med J*, **2**, 971.

Ochsner A., and Mahorner H (1939) *Varicose Veins* St. Louis C. V Mosby Company
— and Smith, M C. (1940) "The Use of Vitamin B_1 for the Relief of Pain in Varicose Ulcers" *J Amer med Ass* 114 947
Owens, N (1937) "Treatment of Chronic Varicose Ulcers of the Lower Extremities." *N Orleans med. Surg J.*, 89 483
Panting, A. E. (1933) "Varicose Ulcer" *Med J Aust* 2, 860
Roland, P E. (1948) Treatment of Chronic Varicose Ulcer" *Brit med J* 2, 399
Rubenfoeld, S (1934) "Epithelioma Developing in a Varicose Ulcer" *Amer J Surg.*, 26 372.
Russell B. and Thorne, N A (1955) "Skin Reactions beneath Adhesive Plasters" *Lancet* 1 67
Schmier A A (1934) Treatment of Varicose Ulcers. *Amer J Surg* 23 195
Semon, H C. G., and Moritz, A (1934) *An Atlas of the Commoner Skin Diseases* Bristol John Wright.
Severinus, M A. (1646) *De Efficaci Medicina Lib III* 68 Frankfurt.
Smith, F L. (1932) Treatment of Varicose Ulcer" *Proc Mayo Clin.*, 7 497
Solomons, B (1951) "Aureomycin Its Topical Use in some Skin Diseases." *Brit med J* 2 525
Spencer S L. (1946) "Varicose Veins and Varicose Ulcers." *Bull Post-grad Committee in Medicine University of Sydney* 2, 54
Thorsen, G (1945) "Pressure Pavex Treatment of Varicose Ulcers and Stasis of Extremities." *Arch phys Med.*, 26, 638
Troensegaard Hansen, E. (1950) "Amniotic Grafts in Chronic Skin Ulceration *Lancet* 1 859
Wright, A D (1930a) "Treatment of Varicose Ulcers. *Brit med. J* 2, 996
— (1930b) "Treatment of Varicose Ulcers." *Proc R. Soc Med.*, 23 1032.
— (1931) "Treatment of Indolent Ulcer of the Leg." *Lancet* 1 457
— (1940) "Complications of Varicose Veins." *Brit med J* 1 699
Zimmerman, L. M (1936). "Pathogenesis of Cutaneous Complications of Varicose Veins." *Arch Derm Syph., Chicago*, 34 97

CHAPTER 17

TREATMENT OF THE INDURATED AND ULCERATED LEG BY SURGICAL MEASURES

We all realize that ulcers can be healed by bed rest and compression To keep them healed, however, means that the patient must not only lead a new life, but must also continue indefinitely with supportive treatment. For these reasons we look to surgery for a more permanent " cure " What can surgery offer which conservative treatment fails to give? I would answer this by saying that even with the most thorough surgical technique, we are usually still left with a limb which needs support What, therefore, do we achieve by submitting the patient to all the trials of surgery?

I think that we can on occasions save the patient's time, as in the grafting of a large surface ulcer Again, we can remove a deficient superficial system and thereby relieve the limb from this added embarrassment Again, in certain cases, the excision of faulty communicating veins can help the ulcer to remain healed with less cumbersome support than would otherwise have been necessary

Surgery has its place in the treatment of venous ulceration, but in my opinion it is a limited one, and must be used essentially for the failures of conservative treatment

The surgical methods at our disposal may be summarized as follows

(1) The eradication of a faulty superficial system
(2) The skin grafting of an ulcer slow to heal
(3) The excision of faulty communicating veins by
  (a) Sub-fascial operation
  (b) Extra-fascial operation

The eradication of a faulty superficial venous system

As discussed in the chapter on general surgical treatment (page 110), the indication for stripping the superficial system in the presence of venous ulceration resulting from previous deep vein thrombosis may be stated as follows If, on test, it is obvious that the enlarged incompetent superficial varices are an added embarrassment to the thrombosed deep system, it is better to strip the veins The patient must be prepared for operation by physiotherapy and compression until the deep system of veins has recovered sufficiently In other words, *the leg must be slim and of good colour before stripping is performed* This is all-important in order to avoid a further episode of deep vein thrombosis At the time of stripping, skin grafts to the ulcer bed may be considered

Skin grafting

The value of skin grafting rests in the hastening of the healing processes, thereby saving time in treatment Ulcers, however large, will heal in the majority of cases without skin grafting if the cause has been correctly treated In very large ulcers,

however in which epithelization from the margins of the ulcer is slow skin grafting offers the patient the advantage of a firmer scar since the skin after grafting is of a better quality than that produced by marginal epithelization

However efficiently skin grafting may be performed it is of no value whatever unless the basic cause of the ulcer is treated at the same time This may entail (1) prior excision of blow-outs or (2) permanent firm supportive treatment after grafting

On occasions both these procedures may be necessary otherwise however successful a result grafting may give, it will only be temporary and re ulceration will occur before very long I confine skin grafting chiefly to the limb which is the seat of a large superficial ulcer as shown in Fig 285 It is essential that the limb should be in a fit condition to receive the graft and this entails treatment directed at (1) the removal of induration and oedema, and (2) the production of a clean ulcer surface

As a rule elevation of the limb in bed exercises massage, etc will produce a soft and slim limb in a short time There are many methods of cleaning an ulcer bed If the tissues are infected and necrotic cleansing and débridement can be expedited by the use of one of the enzyme preparations containing trypsin I usually use Tryptar ointment, applying it two or three times daily for not more than two to three days Once the necrotic tissue has separated weak eusol soaks are useful The dangers attendant upon the over-enthusiastic use of local antibiotics have already been described Frequent smears, in order to note the bacteriology are of help but it is not necessary to secure a completely negative culture. The presence of haemolytic streptococci should stay the hand of the surgeon until a negative culture occurs From the practical angle the ulcer bed must have a red healthy appearance before it is ready to receive a graft If the granulations are too prominent localized pressure treatment by means of a polyurethane foam pad will flatten out the ulcer bed sufficiently for treatment



FIG 285 —This type of large ulcer although it will heal by the usual measures, is better skin grafted since this will not only shorten the length of treatment but it will give the opportunity of a firmer scar being formed eventually

To summarize the limb is made slim and soft by means of compression exercises physiotherapy and massage and the ulcer bed is cleansed prior to grafting

The types of grafting in most common use are those of the pinch and split types The former have the advantage of being applicable as an out-patient procedure and are only suitable for small ulcers The use of split grafts entails general anaesthesia and is an in-patient procedure I personally have given up using pinch grafts, finding it much more satisfactory to cover the ulcer completely with a thin split-skin (Thiersch) graft However, there are occasions when this is not possible, and for this reason we will begin with a description of pinch grafting

Pinch grafts

Pinch grafts are satisfactory in ulcers which are not too large This grafting may be performed under local anaesthesia, the donor site being situated on the thigh of the same leg Every precaution must be taken that this site does not

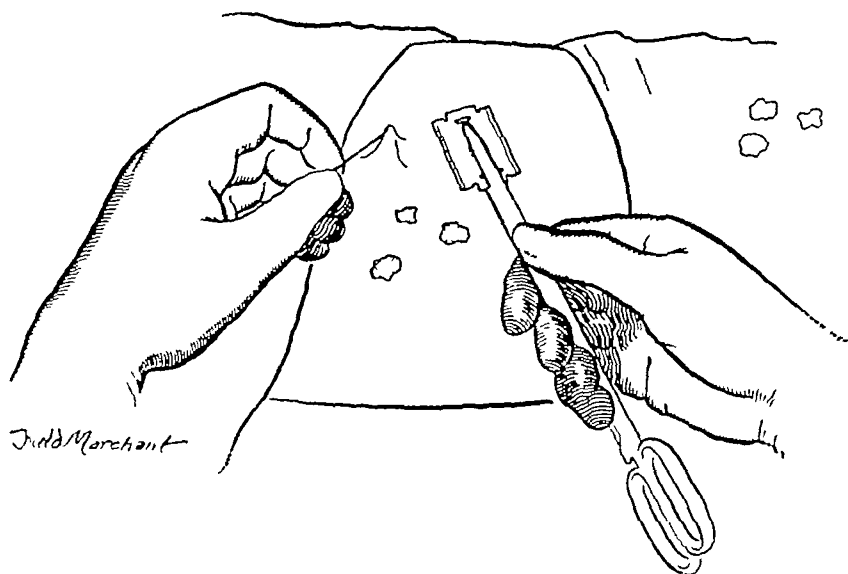


FIG 286 —Skin grafting A method of obtaining pinch grafts A needle and a safety-razor blade held in a pair of artery forceps are all that is required The method of applying these grafts is described in the text

become infected at the time of operation A small portion of skin is lifted by means of a needle and cut through its entire thickness with a safety-razor blade held in a pair of forceps (Fig 286) The needle with the graft on it is then passed to an assistant, who places it on the ulcer The needle is placed in Lysol solution, whilst a further needle is being used for the next graft Several needles are used and rotated through the Lysol bowl, so as to prevent infection passing back from the ulcer to the donor site The needles are rinsed through saline after leaving the Lysol bowl It will be found that, if the operation has been done with care and no bleeding has occurred, quite a high percentage of the grafts will be viable If grafting is performed at the same time as the operation for high resection of the internal saphenous vein this latter procedure must be carried out first, and in this case leg movements must be kept up every few hours after operation The advantages of doing the operative procedure at the same time are obvious, and there is no added risk provided all gross sepsis has been removed from the ulcer bed prior to operation

An ingenious alternative method has in the past been advocated by Dickson Wright who cut strips of skin under local anaesthesia, tying these to a silk ligature attached to a grafting needle. These strips were darned in and out of the ulcer bed and were found to be more viable than the ordinary pinch grafts The advantage of this method was that it could be used in the out patient department, and it still has a certain value.

The split-skin graft

Before considering the grafting of a large ulcer by means of a split skin graft I restate that it is all-essential that the limb should have been rendered soft, non oedematous and slim by means of the procedures already described Furthermore



Fig 287 —Humby's knife There has been an improvement of this skin-grafting knife which may be obtained with a removable blade resembling a safety-razor blade

the donor site which is usually the thigh of the other limb must be cleansed for two to three days prior to operation with Cetavlon solution

The whole procedure is quite simple and can be performed rapidly once the main essentials are grasped

Grafts may be taken with various types of knife The Humby knife (Fig 287) is, in my opinion the most suitable Many modifications have been made of the original and the Braithwaite modification seems to give us most of the advantages

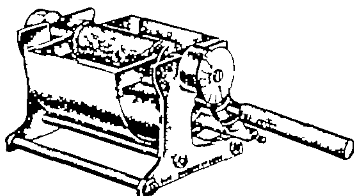


Fig 288 —Padgett s dermatome

of the original Humby knife This allows the use of replaceable blades of the Gillette type obviating all honing and stropping, and ensuring the maximum sharpness The adjustment of the roller is simple allowing us to take various thicknesses of skin Alternative knives are used by many surgeons some still use the original Blair knife others prefer the more complicated types of dermatome such as that illustrated in Fig 288 Generally speaking, thin grafts are better taken with a knife in the hand while the dermatome is reserved for the thicker grafts

The operation

The patient arrives in the theatre with the donor site covered with a sterile towel, while the ulcer itself is protected with a dressing soaked in half strength eusol, covered with a bandage

The ulcerated limb is sealed off with a sterile towel, and the donor site on the thigh of the opposite limb is exposed It is first cleaned with surgical spirit, and then lightly anointed with sterile liquid paraffin The secret of obtaining a good graft from this area lies in the manner in which the assistant presents the skin to the knife In other words (*see* Fig 289) his right hand placed under the thigh pushes the tissues anteriorly while he tenses the skin backwards with the fingers and



FIG 289 —Method of taking a Thiersch graft from the thigh The assistant's right hand is thrusting the thigh forward with the palm while tensing the skin backwards with the thumb and fingers The skin of the selected donor area is flattened and tensed by the boards held in the assistant's and surgeon's left hands The skin and knife may be lubricated with a light film of liquid paraffin to ease the taking of the graft

thumb With his left hand he stretches the skin in an upward direction with the " butterboard " The operator's left hand stretches the skin in a downward direction with a similar board The knife, which has been adjusted to the thickness of skin required, is then used with a sawing movement in a downward direction, and a thin sheet of skin may thus be obtained of any desired size The piece of skin removed is then placed in a bowl of warm normal saline solution until required Having obtained the graft, it is now only necessary to cover the wound with Carbonet and to apply a firm padded *crêpe* bandage to prevent oozing

The application of the graft

The ulcer is now exposed, and if the edges are unduly fibrous they are better excised Excessive granulations should be removed Any bleeding occasioned can be controlled by firm pressure It is useless to apply the graft until such

bleeding and oozing have been completely stopped The graft which has been taken should be roughly the size of the ulcer It is laid on to the ulcer bed and any excess skin is carefully cut away so that the ulcer is accurately covered Any excess skin can be put into a small bottle and placed in the refrigerator in case it may be required at a later stage, if any of the graft fails to take Remember that the edges of the graft always roll *inwards* while it is floating in the saline. Great care must be taken to ensure that the graft is applied the correct way round

Some surgeons prefer to make multiple applications of skin in the form of " postage stamps This method certainly has the advantage that if any oozing takes place the graft is less likely to be lifted from the ulcer bed

Immediate post-operative dressing

The grafted area is covered with Carbonet and small pledgets of cotton wool soaked in flavine and paraffin emulsion are packed and finely shredded over the graft to ensure even distribution of pressure These are covered with two to three layers of sterile gauze soaked in saline and a firm padded *crêpe* bandage is applied This dressing remains in place for 8 days at least without being disturbed

Post-operative care

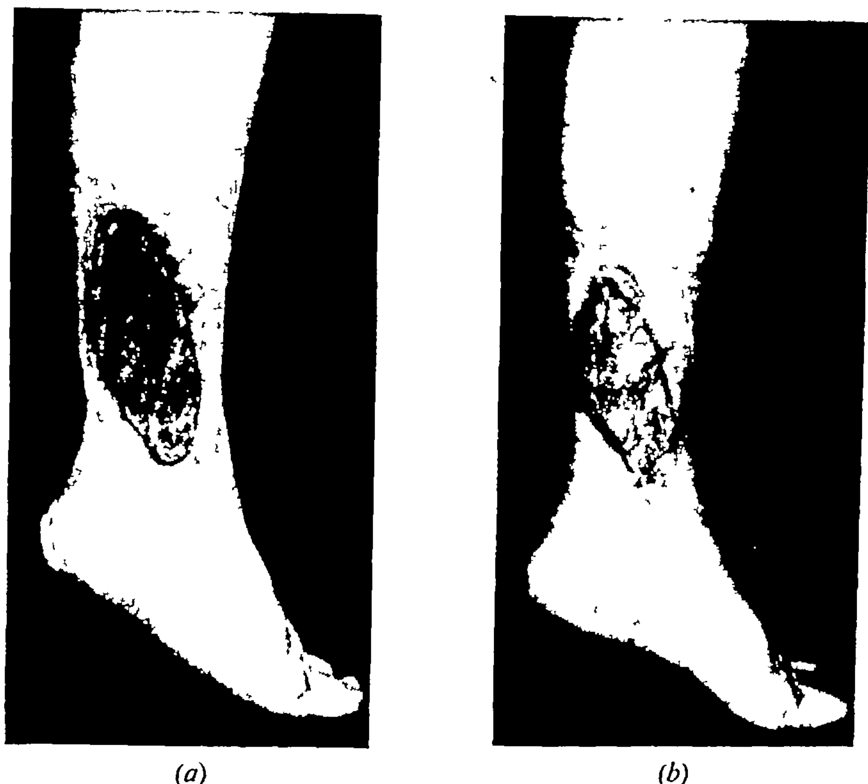
The patient should spend the next eight days in bed the foot of which is elevated at least 12 inches Gentle exercise of the limb is permitted but injudicious movements of the ankle should not be allowed until the graft has taken firmly The donor site remains untouched until the tenth day when the dressing can be soaked off and further dressing is usually not required On the eighth day the grafted ulcer is carefully dressed by the surgeon The greasy dressing should come away without difficulty but care should be taken to avoid disturbing the graft For the next forty-eight hours the grafted area should be dressed with half strength eusol mixed with an equal quantity of liquid paraffin This dressing is then removed and the patient allowed to lie in a bath Subsequent care consists of the application of the eusol–paraffin dressing at night but leaving the wound exposed to the air under a cradle during the day In this way the graft becomes dry and after a few days it is often possible to dispense with the oily dressing at night Once the graft looks thoroughly healthy and has taken firmly a square of polyurethane foam should be placed over the graft area and kept in position by a firm two-way stretch bandage from toe to knee As a rule, after a fortnight massage walking and exercises can be introduced The patient must be instructed that at *no time is the limb allowed to be dependent without the proper application* of a firm dry elastic bandage

Late after-care

The patient must understand that skin grafting is only part of the treatment of the ulcer and does not exclude the necessity for proper support and physiotherapy *Many patients feel that once the ulcer is grafted they are quite safe* and proceed to take liberties with the limb The patient should follow out instructions carefully and may be encouraged by the thought that the eventual support may be made more comfortable for her by means of firm elastic stockings The various methods of supporting the limb are described under the general treatment of induration elsewhere in this manual

The excision of faulty communicating veins

In my opinion, this treatment is usually indicated in those ulcers which fail to heal despite adequate compression treatment Frequent recurrence of ulceration is a further indication I feel that this applies to a comparatively small number of patients, but I know that my conservative views are not generally accepted The



(a) (b)

FIG 290—(a) An indurated ulcer of very many years' standing The ankle is ankylosed and the muscles of the calf are wasted (b) The same leg a few weeks after skin grafting, and after the ankle has been mobilized This woman can now walk comfortably in a firmly applied one-way-stretch bandage with a polyurethane pad over the grafted area The patient is now, after many years, able to carry out her duties normally, free from pain In a case like this incompetent communicators are not obvious, and provided the patient will put up with the compression treatment, she will lead a normal existence Exercises and massage are essential adjuvants to treatment

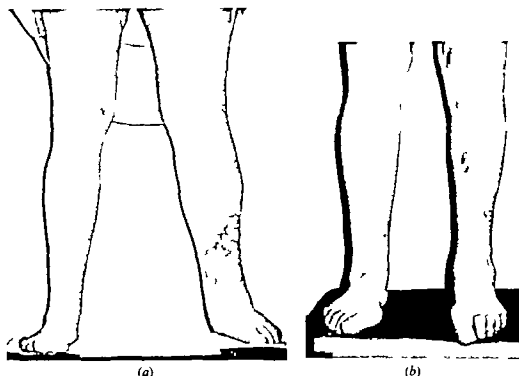
operative procedure on faulty communicating or perforating veins (the ankle blow-out syndrome) may be divided into

(a) The extra-fascial approach

(b) The sub-fascial approach

The extra-fascial operation consists of excising the blow-outs through small incisions made along Langer's lines When stripping a limb of faulty superficial varices we usually mark these faulty communicating veins with circles (*see* Fig 154) We have already felt the hole through the deep fascia with our finger tips at the time of marking the limb The excision of a blow-out extra-fascially is a simple matter (*see* Fig 292), and if after stripping or in the presence of venous ulceration it is thought necessary to remove these faulty communicators, we can do this through small incisions, under local anaesthesia By destroying the local

high pressure leaks in this simple manner the limb is much improved I never find it necessary to make the long incision recommended by Linton Dodd and Cockett (*see* Fig 294) I only want to excise the obviously faulty blow-outs These can be felt by the finger tips as holes in the deep fascia. Remember however that they can only be felt once the limb has been made slim by compression and physiotherapy If at a later period more blow-outs appear they can be dealt with in a similar manner A long slash from below the knee to the ankle will not



(*a*) (*b*)

FIG 291 —(*a*) The left leg is the seat of deep vein thrombosis and severe ulceration This resulted from an operation to the patient's varices three years previously At that time it was presumed that sclerosant was used and deep vein thrombosis ensued. Treatment consisted of dry elastic bandage compression, massage and exercises. Two months later the ulcer was grafted and physiotherapy re-introduced. (*b*) The same limb eight months afterwards The patient is at full work in a shop using a one-way-stretch bandage over the elastic stocking when standing. The bandage is removed whenever *she is sedentary and she continues with her exercises and self massage*

show these embryo blow-outs and their excision will be difficult in any case Take out the obvious ones through small incisions in the way described and forget the heroic operation of Linton (introduced into Great Britain by Cockett)

I had the privilege in 1952 of seeing Linton work on these deep communicators and I still hold to my view that the conservative and more friendly approach which I have always advocated is the better I have not changed my views since the first edition of this manual some eleven years ago

If one regards the foramen ovale as being the counterpart of the hole in the deep fascia through which the incompetent perforators pass the comparison regarding the circulation becomes obvious In other words these incompetent communicating veins are forming a localized faulty circulation in just the same way

as a deficient sapheno-femoral valve will cause a faulty reverse circulation at the foramen ovale

The sub-fascial approach —The method of obliterating the faulty communicators by excising them deep to the fascia was originated and is still practised by Linton of Boston This is an operation I resist I have seen ligation of the femoral and popliteal veins hailed as the right treatment for venous ulceration Who does it now? In the same way I am satisfied that the deep sub-fascial operation on faulty

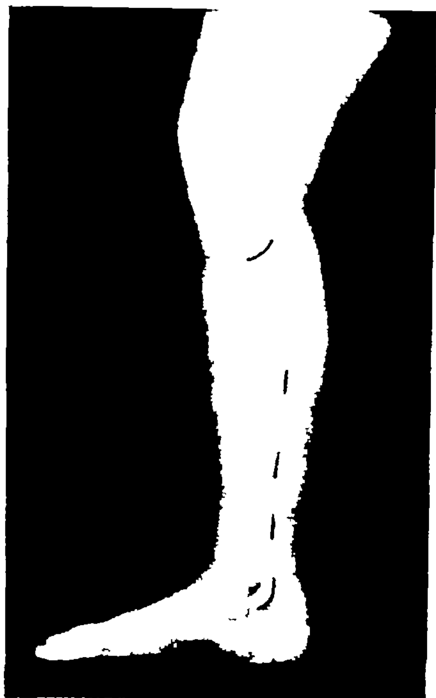


FIG 292 —Leg marked to show the small incisions necessary for extra-fascial ligation of perforating veins at the usual sites Accurate pre-operative location of the "blow-outs" is, of course, essential, thus avoiding the necessity for extensive exploration



FIG 293 —This small but painful ulcer behind the external malleolus healed rapidly after extra-fascial ligation of the "blow-out" immediately above it

communicators (*see* Fig 294) will be relegated to the historical chapter in the course of time in the same way The technique of the operation, however, for those who want to try it, is as follows After pre-operative compression treatment, an incision is made one inch posterior and parallel to the posterior border of the tibia This is a long incision starting more than half-way up the leg and ending at the internal malleolus It is made to cut down to the muscles through the deep fascia The flaps of skin, subcutaneous tissue and deep fascia are retracted in order to expose the perforating veins These are divided and ligated with catgut (I think you will miss quite a few " embryonic " perforators at this time, and will find yourself dealing only with well-established and obvious faulty communicators The embryonic perforators will develop *after* you have sewn up Why, oh why, perform this massive assault on the limb when you can adopt the simple measures advised under the extra-fascial approach?)

A sheet of deep fascia is then excised, and the wound is sutured Even the enthusiasts say that skin necrosis is not uncommon I feel that it is the old story

of using a sledge hammer to crack a nut and I do ask that the reader should consider the simpler approach which I have already discussed For those who wish to follow this massive approach I strongly recommend the description in Dodd and Cockett s (1956) book At the same time note the photographs of patients who have been submitted to this operation taken six months later I

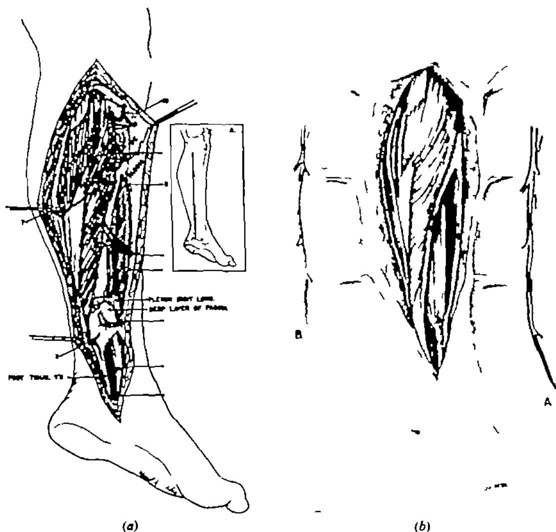


Fig 294—Linton s operation. (a) This shows the very extensive incision and dissection which are involved in the sub-fascial ligation of perforating veins as advocated by Linton. (b) An artist s impression of the final state of affairs once the operation has been completed. Note that the internal and external saphenous veins are removed at the same operation. (*By courtesy of Dr Robert Linton.*)

think the reader may agree with me that an equally good or better result could have been obtained by means of conservative treatment in conjunction with the simple extra fascial excision of perforators I am satisfied by trial and error with this statement It is up to the reader to form his own opinion however!

Again the Linton school (Dodd and Cockett) states This operation should be advised before the ulceration has taken place I personally would sooner have an ulcer

I am interested, however, at the time of writing, to see that a further article by Cockett (1958) on the treatment of venous ulcers shows already a far more conservative approach In other words, the extra-fascial operation is starting to be given priority, and incisions into the devitalized area deep to the ulcer are being avoided Even though this change is welcome, I still claim that the even more conservative measures I have described in this chapter are of more value Support for these views is given in an excellent article by Sheppard (1958) writing on the subject from Adelaide

Other surgical procedures which are sometimes directed at the cure of venous ulceration are

(1) Ligation of the popliteal vein
(2) Sympathectomy
(3) Amputation
(4) Crushing of the great saphenous nerve
(5) Grafting, with amnion

Ligation of the popliteal vein

This procedure has been particularly recommended by Gunnar Bauer during the past years, and much has been written on the subject of both femoral and popliteal ligation by Homans, Linton and Hardy More recently Moore (1953) has published a series of 23 cases and his conclusions, in his own words, are as follows " It seems reasonable to conclude that the operation does no harm, and that in suitable chosen cases it can relieve the patient of symptoms for a considerable time "

At this point it is of interest to note a few points from the summary of Gunnar Bauer's (1951) paper entitled "The sequels of post-operative venous thrombosis "

Deep venous thrombosis, post-operative or of any other aetiology, is followed in 85–90 per cent of all cases by grave sequels, generally arising after an interval of a few years. This post-thrombotic syndrome is made up of oedema of the lower leg, indurative skin changes, ulceration and pain

It was concluded that acute thrombosis practically always (in at least 96 per cent of all cases) originates in the lower leg If no specific treatment is employed, the process rapidly propagates upwards through the femoral vein. There follows organization of the thrombus as well as other changes In the course of a few years the vein is turned into a thick-walled rigid vessel with an irregular lumen and entirely devoid of all functioning valves

The reason for the appearance of the oedema and other symptoms from the lower leg is, probably, the persistent high intravenous pressure in the lower leg when these patients are in the erect position In healthy individuals the high pressure is constantly being relieved as each contraction of the calf muscles squeezes large amounts of blood out of the lower leg into the femoral vein In the post-thrombotic patient this mechanism is out of order The " peripheral heart " cannot function because the necessary valves are missing

As a cause for the post-thrombotic syndrome, vasospasm probably plays an unimportant role

In established cases of the post-thrombotic syndrome present-day treatment follows three lines Those who consider vasospasm to be the responsible factor, generally make use of measures aiming at counteracting this factor, such as lumbar sympathectomy or similar measures Those who think the avalvular state of the femoral

vein is the chief reason for the lower leg stasis endeavour to counteract the venous back flow either by division of the femoral vein at its proximal end or by division of the popliteal vein

The last-mentioned method was employed at the Mariestad Hospital in 440 cases There were no post-operative deaths and no complications of any importance In 234 cases the post-operative time of observation exceeded one year 95 1 per cent of these were followed up The results in 223 extremities followed up for one to four years, were Asymptomatic, 145 (65 per cent) markedly improved, 50 (22·4 per cent) little or not improved, 28 (12·6 per cent)

Thus, the results with popliteal vein division were Good, 87·4 per cent bad, 12·6 per cent With other methods, the results according to some published series, were Antispasmodic treatment, good, 51 2 per cent bad 48 8 per cent high femoral ligation, good, 68·4 per cent bad 31 6 per cent.

The author is in agreement with Boyd (1953) who states that It is our opinion that the operation of major vein ligation in the treatment of the postphlebitic syndrome is neither empirically nor theoretically satisfactory

Lumbar sympathectomy

During the past years lumbar sympathectomy has been used by many surgeons In the experience of the author the results of this treatment do not justify the operation Better results have not been produced than might have been obtained by a correct knowledge of compression therapy Lumbar sympathectomy may find a place however in the treatment of the ulcerated leg if it be accompanied by arterial or trophic changes For the straightforward venous ulcer however it *finds no place*

In answer to a paper on the advantages of lumbar sympathectomy a comment by Harold Dodd (1948) is in complete accordance with the writer s views and is herewith reproduced verbatim

" In reading the case reports of Messrs Borrie and Barling s patients I did not think they had received what could be regarded as an efficient operation for their varicose veins In my experience no ligature, whether high or low single or multiple will permanently clear up varicose veins, ulcer or eczema I find that permanent effectiveness is obtained only by high ligature, division of all the branches, and the certain destruction of the entire column of the internal or external saphenous veins from their beginnings at the malleoli to their endings I think it is essential that treat ment for varicose veins be thoroughly instituted before resorting to the attractive procedure of lumbar sympathectomy which carries a mortality and will be followed by recurrence of the ulceration if the varicose veins, which are a progressive condition, continue to exercise their deleterious effects on the scar tissue about the ankle

" I agree with Messrs Dickson Wright, Rowden Foote, Kenneth Wolferstan and others that all varicose ulcers can be healed if we will apply the supportive bandaging ourselves frequently and faithfully I think that while lumbar sympathectomy has a place in the treatment of ulcerated legs when accompanied by arterial and trophic conditions, it is a small one

Amputation

Fig. 246 (page 274) is a typical picture of severe annular ulcer resulting from deep vein thrombosis. Such a limb where neglect has been present over the years is under certain circumstances better amputated The more experienced one is in the treatment of varicose ulceration however the less likely is one to be driven to take such drastic steps The impossibility of healing the ulcer depicted

in a patient of low mentality, who was quite tolerant of the pain and stinking discharge of her limb, makes one give careful consideration to amputation in such cases

Crushing of the great saphenous nerve

Roland (1948) has written regarding the crushing of the great saphenous nerve below the knee This cutaneous nerve crush in combination with the routine high resection of the internal saphenous vein in his opinion hastens healing The author has no experience of this treatment but, in passing, is interested to note that the procedure was recommended by John Hilton in his famous book *Rest and Pain*

Grafting ulcers with amnion

Troensegaard Hansen's (1950) technique for using amnion instead of skin when grafting finds favour with some surgeons I personally prefer to use skin, but those interested in this technique are recommended to read Hansen's writing on the subject

Summary

(1) The basic treatment of venous ulceration lies in conservative treatment, compression, exercise and support

(2) Surgical treatment directed at the faulty superficial venous system is often necessary

(3) " Blow-outs " or faulty communicating veins should be excised whenever obvious The approach should be *extra*-fascial through small incisions

(4) Criticism of massive sub-fascial operations is offered

BIBLIOGRAPHY AND REFERENCES

Dodd, H (1948) " Lumbar Sympathectomy for Varicose Ulcers " *Brit med J*, 2, 532

Homans, J (1917) " The Etiology and Treatment of Varicose Ulcers of the Leg " *Surg Gynec Obstet*, 24, 300

Linton, R R, and Hardy, I B (1948) " Post-thrombotic Syndrome of the Lower Extremity " *Surgery*, 24, 452

Roland, P E (1948) " Treatment of Chronic Varicose Ulcer " *Brit med J*, 2, 399

NEW REFERENCES

Bauer, G (1951) "The Sequels of Post-operative Venous Thrombosis " *J int Chir*, 11, 205

Cockett, F B (1958) " Venous Ulcers of the Leg " *British Surgical Practice (Surgical Progress, 1958)* London, Butterworth

Dodd, H, and Cockett, F B (1956) *The Pathology and Surgery of the Veins of the Lower Limb* Edinburgh, Livingstone

Hilton, J (1930) *Rest and Pain* London, Bell

Moore, H D (1953) "Ligation of Popliteal Vein for Gravitational Syndrome " *Lancet*, 1, 23

Sheppard, M (1958) " Experience in a Varicose Veins Clinic " *Med J Aust.*, 2, 326

Troensegaard Hansen, E (1950) "Amniotic Grafts in Chronic Skin Ulceration " *Lancet*, 1, 859

Wright, A D (1953) Letter, *Ibid*, 1, 244

CHAPTER 18

LYMPHOEDEMA

In our clinics patients with oedematous legs form a high percentage of those who attend. The various causes of oedema have been considered in Chapter 4 and clinical testing will separate these patients into their proper groups By a process of exclusion a small proportion will be found to be suffering from pure lymph oedema, and although a detailed survey is beyond the scope of this book a brief résumé may help to remind the surgeon of the condition

The term lymphoedema means that there is a swelling of the soft tissues directly due to an increased quantity of lymph in the cellular interspaces In the past elephantiasis was used to describe all such abnormal swellings The term however is better discarded since in modern times we are able to differentiate between so many types of lymphoedema These may however be divided into two main categories (1) *Primary lymphoedema* and (2) *secondary lymphoedema*

Amongst the recognized types of primary lymphoedema are the idiopathic type known as lymphoedema praecox and also the hereditary or familial type known as Milroy s disease These two types are both primary and idiopathic whereas secondary lymphoedema occurs as a result of damage to the lymphatic system from causes such as malignant occlusion pressure or surgical damage to the lymphatic nodes Lymphoedema may also occur after long-standing inflammatory conditions in the limb probably due to sclerosis of the lymphatic channels

The *aetiology* of the primary including the hereditary types is unknown, but there are certain common pathological changes The fatty tissues are replaced by connective tissue and enlarged lymphatic spaces, the subcutaneous tissues becoming indurated. In some cases there is a definite thickening of the skin with an atrophy of the muscular system. Cell infiltration, especially by lymphocytes and leucocytes is commonly present A degree of lymphoedema may be associated with an acute thrombophlebitis, since lymphatic vessels in the saphenous opening area may be involved in the general inflammatory reaction. This point was first brought out by Homans

Patients with lymphoedema suffer from heavy dull aching limbs, but seldom if ever suffer from actual pain The cause of the condition is unknown but it is suggested that there may be a congenital under-development of the lymph glands Furthermore as this condition is confined to the legs the gravitational factor enters into the aetiology The fact that this complaint usually occurs at puberty and is generally in females suggests that the reproductive organs may play some part in the condition. Although the theories are all of great interest, from the practical point of view we must be on the look-out for this condition and make our diagnosis Furthermore we must remember that we are able to reassure our patients that their limbs will not ulcerate. Beyond this it is a most depressing condition, especially for a young girl since treatment is, to say the least, disappointing.

21

Primary lymphoedema

Lymphoedema praecox

Lymphoedema praecox is most commonly found to commence in young females in the second decade of life. Puberty is a common time for the appearance of the first signs. The oedema normally shows in the ankle area and then in the course of time progresses slowly and steadily up the limb. The disease is progressive and in its later stages is associated with tissue hypertrophy. Ulceration and eczema are



FIG 295.—A case of Milroy's disease showing a general enlargement of the right leg which has occurred in several generations.



FIG 296.—Milroy's disease. This term should be reserved for cases of lymphoedema which are both hereditary and congenital, although Milroy's name has been used frequently to describe cases which have not been congenital. The oedema is of the hard lymphatic type, pits on pressure and is diminished after elevation of the limb. Unlike the swollen limb due to deep venous obstruction ulceration and eczema are rarely observed.

rare, the usual history being of a steady slow swelling of the leg unconnected with any other sign or symptom. This is one of the few good points in this intractable disease. Patients should be reassured that they will not develop incapacitating ulcers. Furthermore, it is far more common for one limb only to become involved. Although the progress of the oedematous swelling is usually slow and spread over the years, some patients are unfortunate enough to

belong to the group in which a rapid enlargement of the entire limb may occur in the course of a few weeks or days

Milroy s disease

Congenital hereditary lymphoedema (Milroy s disease) is a most interesting condition affecting one generation after another Sometimes it is not evident until the patient is in the teens For practical purposes all cases of lymphoedema should be questioned regarding similar cases in their ancestry Simple congenital lymph oedema without an hereditary history also occurs These patients will give a history that the limb either in part or whole was swollen at birth Further points in the history will show that throughout there has been no pain and at no time has either eczema or ulceration interfered with the leg. As in other cases of lymphoedema, the limb will pit on pressure but the swelling will be brawny and firm.

Secondary lymphoedema

Inflammatory

This condition presents a past history of recurrent attacks of acute or subacute lymphadenitis Lymphangitis associated with some septic focus in the area drained by the inguinal glands is another cause

The lymphoedema in these cases presumably results from narrowing and occlusion of the lymph vessels by post inflammatory fibrotic changes Each successive inflammatory episode increases this obstruction and the lymphoedema becomes more severe



FIG 297—A section of elephantiasis of the skin. Gross thickening of connective tissue of the skin is shown and numerous dilated lymph spaces lined by a well-marked endothelial layer are to be seen. These changes may be found in cases of advanced lmyphoedema.

The differential diagnosis between lymphoedema and venous oedema can now be considered

The advanced state of lymphoedema is usually easy to differentiate from any other form, since it shows a thickened skin and a hypertrophied limb together with a brawny type of oedema which does not pit like the soft oedema associated with venous insufficiency In addition, stasis ulcers, eczema and varices are not found with lymphoedema. The examiner must remember however that the oedema from gravitational causes may also be associated with that of lymphatic obstruction in the same patient.

Cases of early lymphatic oedema may present difficulties in differentiation but the history is of great help For example, the oedema following childbirth, operation or enteric fever is usually due to the results of thrombosis of the deep veins Oedema usually follows rapidly in the post phlebitic cases but with lymphatic oedema, on the other hand, the history is usually a lengthy one showing a chronic swelling without many other symptoms beyond a heavy swollen leg. This, of course, is not the case if the condition follows any acute cellulitis or lymphangitis in which case the oedema develops rapidly as in post phlebitic cases Again it should be repeated that the oedema resulting from past thrombophlebitis usually follows discomfort or pain in a fairly localized area Bilateral

TABLE 4

DIFFERENTIAL POINTS BETWEEN LYMPHOEDEMA AND OEDEMA DUE TO VENOUS CAUSATION

	Lymphoedema	*Venous Insufficiency*
History	Gradual onset over the years or since birth	Rapid onset—often associated with childbirth, typhoid fever or after operation
Pain	None. Dull ache and general heaviness of limb	Pain acute at onset and often present to a lesser extent later
Skin	Thickened in later stages	Not thickened
Oedema	Hard and brawny Characteristic firm consistency	Softer oedema
Colour	No change	May be cyanosed
Ulceration and eczema	Does not occur	The inevitable end result of indurated oedema due to venous insufficiency
Elevation of limb	Oedema disappears soon	Oedema slow to disappear
Superficial veins	Not dilated	Usually dilated and prominent

A less well understood form occurs in certain specific infectious diseases such as influenza, enteric fever and pneumonia

Enlarged inguinal lymph glands are commonly seen in association with chronic *tinea interdigitalis*, and this is a possible factor which should never be overlooked

Non-inflammatory

Secondary non-inflammatory lymphoedema results from obstruction to the lymph flow by such causes as malignant invasion, surgical removal of glands, or fibrosis following radiotherapy A combination of these factors is the cause of the " brawny arm " so often seen following radical mastectomy

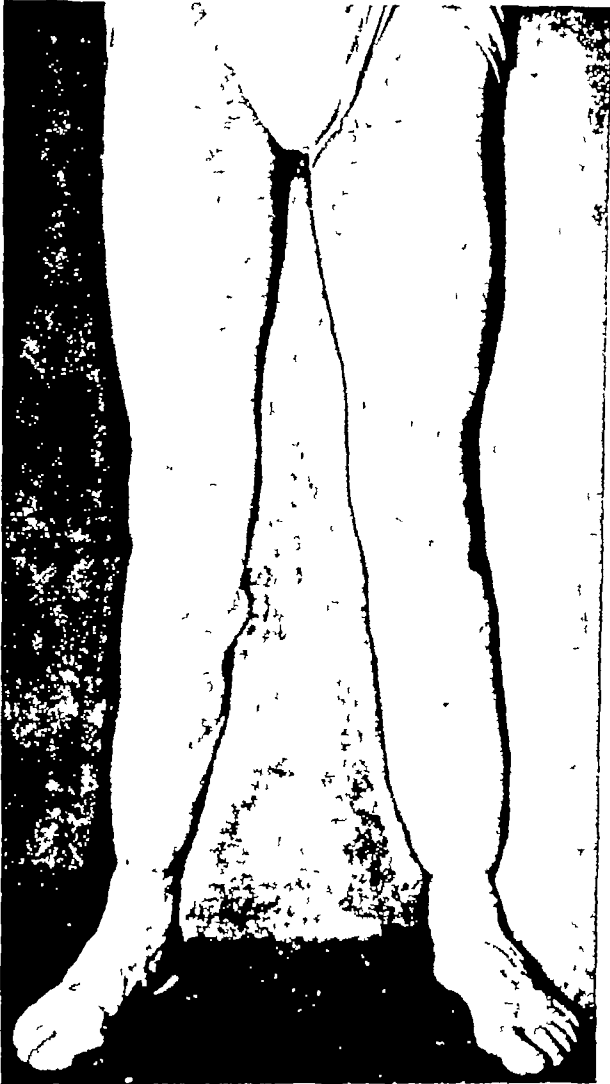


Fig. 298 —The right leg shows severe varicose vein disease with slight oedema The left leg is the seat of advanced lymphoedema The presence of these two separate conditions in the same patient is of great interest Note how the oedema is controlled around the foot and ankle This is due to the wearing of lace-up boots by the patient who is a farmer The right leg will react well to operative treatment and the left leg should be treated by means of a two-way-stretch bandage and massage until sufficiently reduced in size to permit of the application of a firm supportive stocking

Parasitic

The lymphoedema in this group of cases is due to invasion of the lymph channels by *Filariae*, and is responsible for the very great enlargement of the legs or genitalia which is called elephantiasis This condition is rarely seen outside the tropics

Lymphoedema v. venous oedema

The diagnosis of pure lymphoedema is usually straightforward, but it should be remembered that it can be present in the same limb as chronic venous oedema The large quantity of tissue fluid produced by the venous congestion cannot be removed from the limb even by a normally patent lymphatic system, let alone by one narrowed by chronic inflammation

From the practical viewpoint, this combination is of little importance, because the lymphatic element is small and the oedema fluid can be easily re-absorbed by correction of the venous flow

The differential diagnosis between lymphoedema and venous oedema can now be considered

The advanced state of lymphoedema is usually easy to differentiate from any other form, since it shows a thickened skin and a hypertrophied limb together with a brawny type of oedema which does not pit like the soft oedema associated with venous insufficiency In addition, stasis ulcers eczema and varices are not found with lymphoedema. The examiner must remember however that the oedema from gravitational causes may also be associated with that of lymphatic obstruction in the same patient.

Cases of early lymphatic oedema may present difficulties in differentiation but the history is of great help For example, the oedema following childbirth operation or enteric fever is usually due to the results of thrombosis of the deep veins *Oedema usually follows rapidly in the post phlebitic cases*, but with lymphatic oedema, on the other hand, the history is usually a lengthy one showing a chronic swelling without many other symptoms beyond a heavy swollen leg. This, of course, is not the case if the condition follows any acute cellulitis or lymphangitis, in which case the oedema develops rapidly as in post phlebitic cases Again, it should be repeated that the oedema resulting from past thrombophlebitis usually follows discomfort or pain in a fairly localized area Bilateral

TABLE 4

DIFFERENTIAL POINTS BETWEEN LYMPHOEDEMA AND OEDEMA DUE TO VENOUS CAUSATION

	Lymphoedema	*Venous insufficiency*
History	Gradual onset over the years or since birth	Rapid onset—often associated with childbirth, typhoid fever or after operation
Pain	None. Dull ache and general heaviness of limb	Pain acute at onset and often present to a lesser extent later
Skin	Thickened in later stages	Not thickened
Oedema	Hard and brawny Characteristic firm consistency	Softer oedema
Colour	No change	May be cyanosed
Ulceration and eczema	Does not occur	The inevitable end result of indurated oedema due to venous insufficiency
Elevation of limb	Oedema disappears soon	Oedema slow to disappear
Superficial veins	Not dilated	Usually dilated and prominent

lymphoedema may simulate the oedema from systemic disease Once again this shows the importance of a general physical examination of the patient to exclude conditions such as cardiac or nephritic oedema

Treatment

The treatment of this condition in the later stages is extremely difficult and the results disappointing, therefore every endeavour should be made to make the diagnosis early and institute therapy as soon as possible

In the early stages, intensive *massage* and *prolonged supportive bandaging* are rewarding These measures are applied in exactly the same manner as for the indurated oedema of venous insufficiency (*see* Chapter 16) Combined with the frequent use of the *relaxing chair* or other means of elevating the legs above heart

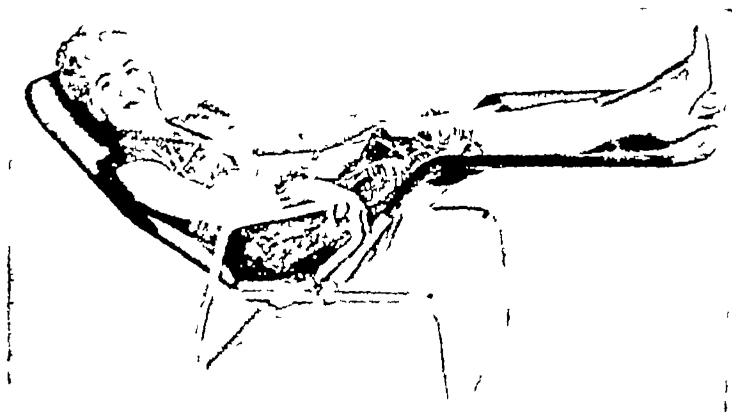


FIG 299 —This chair is of the very greatest value in all cases which show oedema The patient will find that she can perform many of her household tasks while sitting in the chair with her feet elevated Frequent short rests during the day are of far more value than single prolonged periods

level, these measures alone will serve to keep the lymphoedema under control in the vast majority of cases

Operative treatment of lymphoedema is complicated, and even in the hands of experts tends to be disappointing

Advances have, however, recently been made, and the reader who requires further detail is referred to the excellent work of Taylor, Kinmonth, and Wright

Panos, amongst others, has had success with steroid therapy in early cases of lymphoedema I have as yet no experience of this treatment, but feel that it should receive mention

Summary

Summarizing, we must always keep our eyes open for the case of lymphoedema which may be either associated or unassociated with varices As has been shown, an accurate history and a careful examination will usually differentiate these two conditions Remember that the slowly developing brawny oedema unassociated with stasis ulcers will usually fall into the category of lymphoedema The main differential points between lymphoedema and chronic venous insufficiency are summarized in Table 4

The operative treatment of lymphoedema is beyond the scope of this manual, but the importance of conservative measures in the control of this condition is stressed

BIBLIOGRAPHY AND REFERENCES

Allen, E. V (1934) Lymphoedema of the Extremities. *Arch. intern. Med.*, 54 606
Homans, J (1932) "Phlegmasia Alba Dolens and Relation of the Lymphatics to Thrombophlebitis." *Amer Heart J.*, 7 415
Lowenberg, E. L. (1939) Lymphoedema of the Extremities." *Va med. Mon.* 66 345
Milroy W F (1892) An Undescribed Variety of Heredity Oedema." *N Y Med. J* 56 505
— (1928) Chronic Hereditary Edema," *J Amer med. Ass.*, 91 1172.

NEW REFERENCES

Crockett D J (1956) "Protein Levels of Oedema Fluids." *Lancet* 2, 1179
Kettle, H J (1957) "Lymphangiosarcoma following Post Mastectomy Lymphoedema." *Brit med J.*, 1 193
Kinmonth, J B., Taylor G W., Tracy G D., and Marsh, J D (1957) "Primary Lymphoedema." *Brit J Surg.*, 45 1
Panos, T G (1956) 'Prednisone in the Management of Idiopathic Hereditary Lymphedema (Milroy's Disease) " *J Amer med. Ass* 161 1475
Taylor G W (1959) "Lymphoedema." *Postgrad med J.*, 35 2.

CHAPTER 19

THE VARICOSE VEIN CLINIC
EQUIPMENT, DRUGS AND APPLIANCES

I AM NOT altering this page, which I wrote twelve years ago, since I regret to say that progress in the development of clinics for varicose disease is still very slow indeed It is still seldom that we meet with an ulcer which has been properly compressed prior to reference to the clinic, and it is still rare for varices to be referred to us until they have either become complicated or have reached such an advanced stage that surgery is thereby made more difficult Having said this, I will now continue with the page as originally written in the first edition, and am indeed sorry that I am unable to modify the contents

No progress can be made in the study of varicose disease unless a separate department in the hospital be allocated to these patients No longer should this department be the Cinderella of the surgical side, and no longer should the care of sufferers be allocated either to the student or the junior house-surgeon

In spite of the labours of those who are striving to organize the treatment of varicose veins and their complications, there is still no centralized hospital for treatment Furthermore, the treatment of ulceration in general practice is not improving as can easily be seen by questioning patients who come to the clinics Varicose ulceration is still prevalent and compression treatment is by no means generally accepted by the practitioner

The present organization of some varicose vein clinics in Great Britain leaves much to be desired—a fact which may be readily appreciated by any visitor to the average hospital Large numbers of patients with evil-smelling ulcers, and patients who have been submitted to varying types of recurrent surgery, are not an unusual spectacle Patients spend half their lives being paraded weekly for the supply of various ointments, lotions and bandages With proper organization, varicose ulcers can be made a rarity and treatment of an efficient nature can be offered to these people *before* complications arise It is not only in Great Britain that the varix takes the last place among all surgical conditions Let us read what Wickham Lawes of Sydney (1942) says regarding conditions in Australia

> "Here the varicose vein is the humblest and lowliest case Certainly, such cases are banded together and given the name of 'clinic' . No surgeon ever goes near it The assistant surgeon may see some of the cases, but the clinic is generally run by a resident medical officer—the more junior the better, for he cannot pass it on to anybody else He struggles with it valiantly for a few months, injecting countless cases in an endless stream of varicose patients whose thick bundle of out-patients' papers gives evidence of the unavailing efforts of previous harassed medical officers Look at the ulcers and dermatitis cases They are not admitted to the 'clinic' They belong to the dermatologist This unfortunate, foul-smelling group of sufferers huddled in a room with the remnants of Unna's paste and Elastoplast are a sorry group The dermatologist writes 'rep' on most of the cards and, having got through them, then

through the needle at high pressure The syringe is then washed through in a mixture of instrument Dettol and spirit (1 20) followed by similar treatment with ether The needles and syringes are then placed in a solution of instrument Dettol and spirit for several hours prior to re-use This method has certainly stood the test of time as far as I am concerned, and has been quite satisfactory I realize, however, that it may be unacceptable to some surgeons

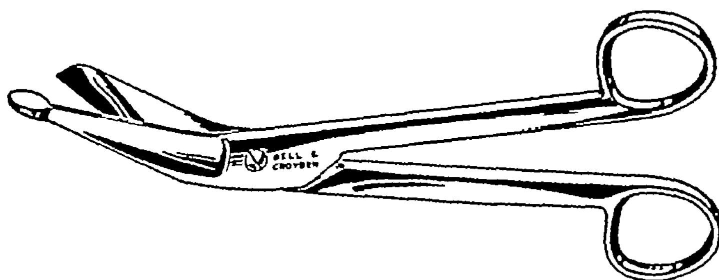


FIG 300 —The bandage shears depicted here are invaluable for removing elastic adhesive bandages and should be found in every varicose vein department

The patient should be clothed in such a way that a complete view of the entire leg and lower abdomen may be obtained. He should stand in front of the examiner on a platform which brings the limbs into easy view in a good light The patient should be instructed to stand with the legs wide apart for his preliminary examination A couch is placed immediately behind the platform so that he may sit or lie down for his injection, the platform being used to support his foot when he is sitting

It is important to keep accurate records of the patient before, during and after treatment The type of form, as used by the author, is reproduced on page 75 The outline of a limb can be placed upon this by means of a rubber stamp, and thus make possible the recording of the exact location of the ulcer. The ideal record is an accurate photograph of the patient before and after treatment This is not practicable, however, and the best use of pen and pencil must be made Unless accurate notes are kept there will be no progress in the finer parts of the treatment It is particularly important that a record should be kept of the degree of sclerosis obtained by various types of injection and the exact results of all surgical techniques An alternative method of measuring ulcers is shown pictorially on page 331

SOME PRESCRIPTIONS OF GENERAL USE IN THE CLINIC

Very few drugs are used in the varicose vein clinic A few prescriptions are sometimes required for varicose eczema Even these can be avoided by the use of the excellent medicated bandages which are now at our disposal For the senile, dry, scaly type of eczema, the old-fashioned coal-tar ointment is sometimes very effective (*see* Fig 232) The prescription is as follows

Picis Carb – –	1 dr.
Zinc oxid – –	1 dr
Vaseline – – –	½ oz
Adeps Lan Hydros –	½ oz

It is as well not to use this for the weeping eczema, since on occasions it may produce a reaction The Coltapaste bandage supplies this tar in a convenient manner, and a degree of support can be given to the limb by a firm *crêpe* bandage

placed over it A further elastic bandage can then be superimposed when indicated Pruritus also sometimes reacts to an antihistamine ointment, which is worth a trial in resistant cases Tincture of benzoin compound (friar's balsam) is a useful application for a weeping eczema before the application of a supportive bandage It must not be used repeatedly, since some patients are allergic to its



Fig 303 —An infra-red photograph of a mild case of varices This picture is incorporated in this chapter in order to emphasize the value of photography as a method of recording the condition of limbs which are the seat of varicose disease This picture demonstrates the position of the saphenous opening and shows the three main superficial tributaries joining at this point

application Friar's balsam has an excellent drying effect and its use will be required on many occasions Gentian violet is useful in a 2 per cent solution in water as a mildly antiseptic and drying application which may be used with advantage underneath a supportive bandage Linimentum Calaminae Oleosa (*B P C*) is a useful emollient and soothing application for the dry, scaly eczema and may be used as a vehicle for resorcin, Ichthyol and so on Ichthammol lotion

is best made up as a 50 per cent aqueous solution Gentian violet paint may be used as a 2 per cent aqueous solution One per cent hydrocortisone skin lotion or ointment has a definite place in the resistant case

Burows solution is sometimes valuable in the treatment of varicose eczema and may be used when fungus infection is suspected I reserve this solution for the wet type of weeping eczema. It consists of a solution of aluminium subacetate and may be dispensed in a 1 8 solution with the instructions that 1 teaspoonful be added to a tumblerful of water Gauze should be saturated in this lotion and applied frequently to the affected parts

Tinea cruris, tinea interdigitalis and tineal ulcers may be treated with *Whitfield's ointment* which has the following prescription

Acid Benz.	–	–	24 gr
Acid. Salicyl.	–	–	15 gr
Paraff Dur	–	–	66 gr
Ung. Simp	–	–	66 gr
Ol Cocois ad	–	–	480 gr

This ointment has stood the test of time and, if it is rubbed in gently with cotton wool after a bath it is usually most efficacious Once the inflammation is controlled the patient should be told to paint the affected part with tincture of iodine, 1 part, and surgical spirit, 2 parts for a few days Phytodermine ointment and powder are useful for some cases the powder being especially useful as a prophylactic.

Potassium permanganate foot baths are all important and this solution is also useful for cleaning up septic ulcers in which case the wound should be immersed for 20 minutes twice a day in a solution which should be pale pink and tepid The many fungicidal powders now on the market are most effective in cases where the interdigital skin has become sodden

Penicillin and *sulphanilamide* should not be used locally on an ulcer When these substances were first discovered great hopes of their use in varicose ulceration were entertained but time has shown that more harm than good may come from their use Sensitization to these drugs may be the most troublesome condition to put right. Amongst the antibiotics, however *tyrothricin* is of particular value to us since it may be applied topically without danger of sensitizing the patient to antibiotics administered either orally or parentally such as penicillin streptomycin aureomycin etc. The anti-bacterial activity of this substance is exerted more rapidly than is that of penicillin and it provides or exerts a prolonged contact at the site of application whereas penicillin is readily absorbed. Used either in the form of a cream or as a wet compress frequently renewed it is invaluable in cleaning up the preliminary discharges in many of our ulcer cases

Monro (1951) has added a most useful contribution to this subject in a letter which appeared in the *British Medical Journal* He stated that heavily infected ulcers of the leg reacted favourably to the use of streptomycin which he considered to be a most potent weapon Since frequent applications are always necessary resulting in in patient treatment, he evolved a method by which this could be used by out patients The ulcer and its surroundings were cleaned up and twelve layers of gauze were applied to the ulcer The area was then covered with waterproof Elastoplast bandage and 20 millilitres of streptomycin solution (1 gramme in 100

millilitres) were then injected through the covering so as to saturate the gauze (Fig 304) The leg was then bandaged and 5–10 millilitres of solution were injected daily for five days—this usually being adequate In some cases he found that daily injections were not necessary In our opinion this treatment is rarely necessary, and we must point out that the therapy must be limited to a short period owing to the risk of sensitization

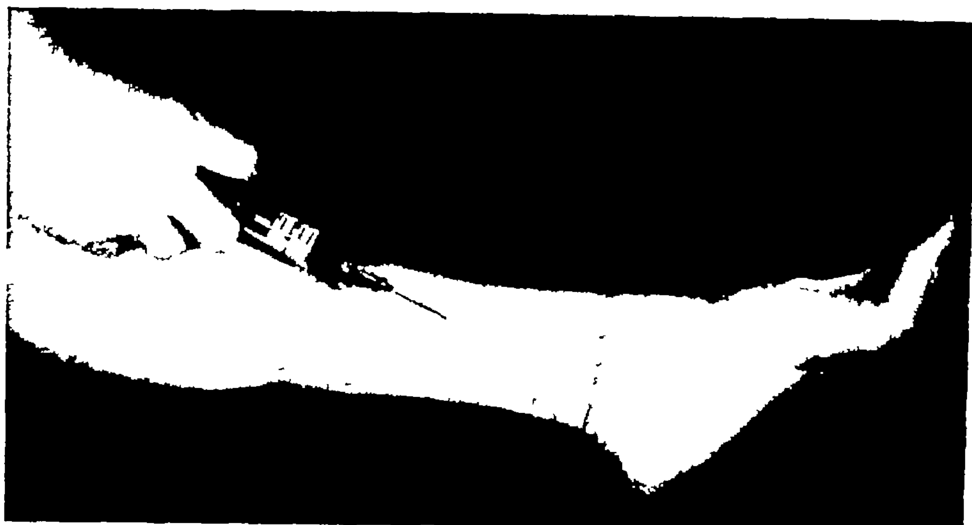


FIG 304 —Streptomycin in the ambulatory treatment of varicose ulceration

An alternative to this method is to apply daily pads of gauze soaked in 1 1,000 streptomycin solution Sensitivity reactions are always likely to occur, however, and it is therefore wise to limit the use of streptomycin or achromycin applications to four or five days only Penicillin should never be used

At this time also we should not forget some of the older dressings such as that of eusol, which is useful in clearing up a septic ulcer bed prior to the application of compression bandages

In a large clinic, organization may be improved by attending to patients with ulcers on days other than those allotted to the patients who require injections or surgical treatment It should always be borne in mind that, in the case of varicose ulcer, the co-operation of the patient must be obtained before prolonged treatment is given Without this co-operation, recurrences and failures may become most depressing With the active help of the patient, other things being equal, all varicose ulcers can be healed and kept healed This encouragement must constantly be offered to the patients in the varicose ulcer clinic

Finally, it must be appreciated that no successful varicose vein clinic can be organized without the help of nurses, chemists and surgical instrument makers

The physiotherapist, as we have stressed so frequently, takes a most important part in the running of the varicose vein clinic Massage in particular is of importance for the indurated leg and the masseuse requires a special knowledge in dealing with this condition As an example of the types of rubbing suitable for the hardened limb the reader is referred to Fig 273 and to the physiotherapeutic details on pages 295–301 Not the least of the masseuse's duties is to teach active movements and exercises to the patients to encourage them and to endeavour

to make them carry out treatment for themselves So many of the patients are indolent but the majority can be educated regarding self-care in the course of time

The out patient nurse who is condemned to this department may approach it with the fear of boredom. It is the duty of those in charge of the clinic to see that her interest is aroused and held She should be taught the correct method of bandaging and should be made to realize how much depends upon her in the healing of ulcers by correct and careful compression treatment.

The co-operation of chemists and instrument makers must be sought in the production of the various types of instruments and medicaments which are constantly changing in an attempt to defeat this most ubiquitous adversary the varix

Finally all sufferers from varices can be benefited by treatment, and all cases of varicose ulceration, other things being equal, can be healed There is no routine treatment and all cases must be judged on their merits The subject becomes more fascinating the longer it is practised and at the end of every year it is a satisfaction to look back and to appreciate how many sufferers are once again walking in comfort, and how many have been able to return to work

CONCLUSION

Although I ask my readers to keep an open mind regarding all the interesting sidelights on therapy I do appeal once again for a conservative attitude towards that which after all is a non lethal disease in the very vast majority of cases In the past editions of this manual popliteal and femoral ligations have been resisted Sympathectomy for ulceration has been criticized, and now I do feel that great caution should be adopted regarding the importation of Linton s sub-fascial operation into this country I feel that this massive anatomical dissection of the leg recommended by Cockett and others should be reserved for the exceptional case only I repeat this statement, since I wish to close this book on a note of conservatism Remember that the ideal treatments of the day are not always available For example, the hospital bed situation in Great Britain and in some other countries does not allow of the admission and surgical treatment of all the sufferers from varicose ulceration For this reason it is essential that the practitioner should be fully conversant with compression treatment by varied bandage techniques All cases can be benefited and often healed prior to surgical treatment and all cases can get rapidly worse from the neglect of this subject which is free for all to learn The days of ointments and certificates " for varicose ulceration should disappear

Furthermore, when considering each case from the surgical angle care should be taken to avoid *routine* treatment. The more the surgeon has to deal with this subject, the more varied will be his attitude to each individual case, and the more interest he will obtain from this most fascinating of subjects which has tried the skill of so many for thousands of years.

The treatment of varicose veins is an ever controversial subject and for this reason I have tried very hard to present the views of others throughout this book. At the same time I have stressed my own personal ideas and have emphasized that in the past few years the operation of stripping by a careful technique offers the sufferer his best chance. A further advance, that of physiotherapy for the indurated leg is a subject of great importance and receives particular mention

That this treatment should be reserved for the *later* stages of treatment and not for the early stage as recommended by Bisgaard is, I think, a point of importance, especially from the economic angle Compression treatment as presented throughout the ages is still a first weapon of defence against the ulcer. Sclerotic treatment, although more limited in its use, receives a special chapter for those who still practise this method, since I feel that even now it still has a definite place in therapy At the close of this book I feel I must mention these points yet once again, so that the reader will realize that there is always scope for originality in all our treatments I hope that by reading these views, both of mine and of others, he will be able to form his own opinions without undue bias from what I have written There is no subject in which good treatment will produce more gratitude and there is certainly no subject which will make us realize our own limitations more acutely If what I have written but causes controversy, it will have served a useful purpose by raising discussion over this most troublesome foe—the varix

Finally, even in these days in which private enterprise and individual initiative are looked at askance by so many, the words of Sir Benjamin Brodie, one of the greatest investigators on this subject, still apply

> "Whosoever is sufficiently vain, or sufficiently idle, to rest contented, at any period of his life, with his present acquirements, will soon be left behind by his more diligent competitors "

BIBLIOGRAPHY AND REFERENCES

Lawes, C H W (1942) " Varicose Veins in Peace and War " *Med J Aust* , 2, 499
Monro, A K (1951) "Applying Streptomycin to Gravitational Ulcers " *Brit med J* , 2, 971

APPENDIX

Throughout this manual reference is made to various bandages and instruments, and for the information of the reader those used by the authors may be obtained from the following manufacturers.

Elastic Adhesive Bandages

T J Smith & Nephew Ltd., Neptune Street Hull

Medicated Bandages

Messrs. Dalmas & Co., Leicester

Dry Elastic Bandages

The one-way two-way and long-life elastic bandages are supplied by Messrs John Bell & Croyden, Wigmore Street, London W 1

Elastic Stockings

The Scholl Mfg. Co Ltd 182–204 St John Street, London, E.C 1

Instruments

All instruments, such as the retractors, strippers, plastic compressors etc are supplied by Messrs. John Bell & Croyden, Wigmore Street, London, W 1

Special Chair (Figs 191 299)

Messrs. John Bell & Croyden, Wigmore Street, London, W 1

We are grateful to these manufacturers for their help in supplying the tools with which we work and we are happy to show our appreciation by mentioning their names in this Appendix

INDEX OF SUBJECTS

U

INDEX OF AUTHORS

A

B

C

